HIGHLIGHTS

REVISION NO. 33 Jun 01/10

Pages which have been revised are outlined below, together with the Highlights of the Revision

CH/SE/SU C PAGES	REASON FOR CHANGE	EFFECTIVITY
CHAPTER 73		
L.E.P. 1- 3	Revised to Reflect this revision indicating new,revised, and/or deleted pages	
T. OF C. 1- 3	Revised to reflect this revision	
73-12-02 601	Mod.3626M4608 incorporated No definition	
73-13-01 407	Minor additions and amplification REVISED FIG."FUEL NOZZLE - REMOVAL/INSTALLATION (PRE SB GE 73-253 AND PRE SB GE 73-337)(SHEET 1/3)"	
73-13-03 401- 402, 404- 406, 408- 436	Minor additions and amplification Layout improved	
73-13-03 601- 618	Minor additions and amplification REVISED EQUIPMENT AND MATERIALS TABLE. ADDED VISUAL INSPECTION OF THE FUEL MANIFOLDS AT LOCATION OF LOOP CLAMPS Layout improved	
73-23-04 401, 403	Minor additions and amplification CORRECTED C/B.	
73-33-11 901- 905	Mod.3626M4608 incorporated No definition	

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CHAPTER 73

ENG. FUEL & CONTROL

LIST OF EFFECTIVE PAGES

N, R or D indicates pages which are New, Revised or Deleted respectively
Remove and insert the affected pages and complete the Record of Revisions and the Record of Temporary Revisions as necessary

CH/SE/SU	C	PAGE	DATE
RECORD			
OF TEMP.			
REVISION			
L.E.P.	R	1- 3	Jun01/10
T. of C.	R	1	Jun01/10
T. of C.	R	2	Jun01/10
T. of C.	R	3	Jun01/10
73-00-00		1	Jun01/04
73-00-00		2	Jun01/04
73-00-00		3	Jun01/04
73-00-00		4	Jun01/04
73-00-00		5	Jun01/04
73-00-00		6	Jun01/04
73-00-00		7	Jun01/04
73-00-00		8	Dec01/90
73-00-00		9	Jun01/04
73-00-00		10	Jun01/04
73-00-00		11	Jun01/04
73-00-00		12	Jun01/04
73-00-00		13	Jun01/04
73-00-00		14	Jun01/04
73-00-00		15	Jun01/04
73-10-00		1	Jun01/04
73-10-00		2	Dec01/90
73-10-00		3	Jun01/04
73-10-00		4	Jun01/04
73-10-00		5	Jun01/04
73-10-00		6	Jun01/04
73-10-00		7	Jun01/04
73-10-00		8	Jun01/04
73-10-00		9	Jun01/04
73-10-00		10	Jun01/04
73-10-00		11	Jun01/04
73-10-00		12	Dec01/90
73-10-00		13	Jun01/04
73-10-00		14	Jun01/04
73-10-00		15	Jun01/04
73-10-00		16	Jun01/04

CH/SE/SU	C	PAGE	DATE
73-12-01		401	Jun01/04
73-12-01		402	Jun01/04
73-12-01		403	Jun01/04
73-12-01		404	Jun01/04
73-12-01		405	Jun01/04
73-12-01		406	Jun01/04
73-12-01		407	Jun01/04
73-12-01		408	Jun01/04
73-12-01		409	Jun01/04
73-12-01		601	Jun01/04
73-12-01		602	Jun01/04
73-12-02		401	Jun01/04
73-12-02		402	Jun01/04
73-12-02		403	Jun01/05
73-12-02	N	601	Jun01/10
73-12-03		401	Jun01/04
73-12-03		402	Jun01/04
73-12-03		403	Jun01/04
73-12-03		404	Jun01/04
73-12-03		601	Jun01/04
73-12-04		401	Jun01/04
73-12-04		402	Jun01/04
73-12-04		403	Jun01/07
73-12-04		601	Jun01/04
73-12-04		602	Jun01/04
73-13-01		401	Jun01/04
73-13-01		402	Jun01/04
73-13-01		403	Jun01/04
73-13-01		404	Jun01/04
73-13-01		405	Jun01/04
73-13-01		406	Jun01/04
73-13-01		407	Jun01/04
73-13-01		408	Jun01/04
73-13-01		409	Jun01/04
73-13-01		601	Jun01/04
73-13-01		602	Jun01/04

CH/SE/SU	C	PAGE	DATE
73-13-01		603	Jun01/04
73-13-01		701	Jun01/04
73-13-03	R	401	Jun01/10
73-13-03	R	402	Jun01/10
73-13-03		403	Jun01/04
73-13-03	R	404	Jun01/10
73-13-03	R	405	Jun01/10
73-13-03	R	406	Jun01/10
73-13-03		407	Jun01/04
73-13-03	R	408	Jun01/10
73-13-03	R	409	Jun01/10
73-13-03	R	410	Jun01/10
73-13-03	R	411	Jun01/10
73-13-03	R	412	Jun01/10
73-13-03	R	413	Jun01/10
73-13-03	R	414	Jun01/10
73-13-03	R	415	Jun01/10
73-13-03	R	416	Jun01/10
73-13-03	R	417	Jun01/10
73-13-03	R	418	Jun01/10
73-13-03	R	419	Jun01/10
73-13-03	R	420	Jun01/10
73-13-03	R	421	Jun01/10
73-13-03	R	422	Jun01/10
73-13-03	R	423	Jun01/10
73-13-03	R	424	Jun01/10
73-13-03	R	425	Jun01/10
73-13-03	R	426	Jun01/10
73-13-03	R	427	Jun01/10
73-13-03	R	428	Jun01/10
73-13-03	R	429	Jun01/10
73-13-03	R	430	Jun01/10
73-13-03	R	431	Jun01/10
73-13-03	R	432	Jun01/10
73-13-03	R	433	Jun01/10
73-13-03	R	434	Jun01/10
73-13-03	R	435	Jun01/10
73-13-03	N	436	Jun01/10
73-13-03	R	601	Jun01/10
73-13-03	R	602	Jun01/10
73-13-03	R	603	Jun01/10
73-13-03	R	604	Jun01/10

Printed in France

CH/SE/SU	C	PAGE	DATE
73-13-03	R	605	Jun01/10
73-13-03	R	606	Jun01/10
73-13-03	R	607	Jun01/10
73-13-03	R	608	Jun01/10
73-13-03	R	609	Jun01/10
73-13-03	N	610	Jun01/10
73-13-03	N	611	Jun01/10
73-13-03	N	612	Jun01/10
73-13-03	N	613	Jun01/10
73-13-03	N	614	Jun01/10
73-13-03	N	615	Jun01/10
73-13-03	N	616	Jun01/10
73-13-03	N	617	Jun01/10
73-13-03	N	618	Jun01/10
73-13-04		401	Jun01/04
73-13-04		402	Jun01/04
73-13-04		601	Jun01/04
73-20-00		1	Jun01/04
73-20-00		2	Jun01/04
73-20-00		3	Jun01/04
73-20-00		4	Dec01/90
73-20-00		5	Jun01/04
73-20-00		6	Jun01/04
73-20-00		7	Jun01/04
73-20-00		8	Jun01/04
73-20-00		9	Jun01/04
73-20-00		10	Jun01/94
73-20-00		11	Jun01/04
73-20-00		12	Jun01/04
73-20-00		13	Jun01/04
73-20-00		14	Jun01/04
73-20-00		15	Jun01/04
73-20-00		16	Jun01/04
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73-20-00		18	Jun01/04
73-20-00		19	Jun01/04
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73-20-00		22	Jun01/04
73-20-00		23	Jun01/04
73-20-00		24	Jun01/04
73-20-00		25	Jun01/04
73-20-00		26	Jun01/94
73-20-00		27	Jun01/04
73-20-00		28	Jun01/04
73-20-00		29	Jun01/04
73-20-00		30	Jun01/04
73-20-00		31	Jun01/04
73-20-00		32	Jun01/04
73-20-00		33	Jun01/04
73-20-00		34	Jun01/94
73-20-00		35	Jun01/04
73-20-00		36	Jun01/04
73-20-00		37	Jun01/04
73-20-00		38	Jun01/04
73-20-00		39	Jun01/04
73-20-00		40	Jun01/04
73-20-00		41	Jun01/04
73-20-00		42	Jun01/04
73-20-00		43	Jun01/04
73-20-00		44	Jun01/04
73-20-00		45	Jun01/04
73-21-01		401	Jun01/04
73-21-01		402	Jun01/04
73-21-01		403	Jun01/04
73-21-01		404	Jun01/04
73-21-01		405	Jun01/04
73-21-01		406	Jun01/04
73-21-01		407	Jun01/04
73-21-01		408	Jun01/04
73-21-01		409	Jun01/04
73-21-01		410	Jun01/04
73-21-01		411	Jun01/04
73-21-01		412	Jun01/04
73-21-01		413	Jun01/04
73-21-01		501	Jun01/04
73-21-01		502	Jun01/06
73-21-01		503	Jun01/06
73-21-01		504	Jun01/04
73-21-01		505	Jun01/04
73-21-01		506	Jun01/06
73-21-01		507	Jun01/04
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73-21-01		510	Jun01/06
73-21-01		511	Jun01/05
73-21-01		512	Jun01/04
73-21-01		513	Jun01/04
73-21-01		601	Jun01/04
73-21-01		602	Jun01/04
73-21-01		801	Jun01/04
73-21-01		802	Jun01/04
73-21-01		803	Jun01/04
73-21-02		401	Jun01/04
73-21-02		402	Jun01/04
73-21-02		403	Jun01/04
73-21-02		601	Jun01/04
73-21-02		602	Jun01/04
73-21-07		401	Jun01/04
73-21-07		402	Jun01/04
73-21-07		403	Jun01/04
73-23-00		401	Jun01/04
73-23-00		402	Jun01/04
73-23-00		403	Jun01/04
73-23-00		501	Jun01/04
73-23-00		502	Jun01/04
73-23-00		503	Jun01/04
73-23-00		504	Jun01/04
73-23-00		505	Jun01/04
73-23-00		506	Jun01/04
73-23-00		507	Jun01/08
73-23-00		508	Jun01/08
73-23-00		509	Jun01/04
73-23-00		510	Jun01/04
73-23-00		511	Jun01/04
73-23-00		512	Jun01/04
73-23-00		513	Jun01/04
73-23-00		514	Dec01/06
73-23-00		515	Jun01/04
73-23-00		516	Jun01/04
73-23-00		517	Jun01/08
73-23-00		518	Jun01/08
73-23-00		519	Dec01/06
73-23-00		601	Jun01/04
73-23-00		602	Jun01/04
73-23-04	R	401	Jun01/10
73-23-04		402	Jun01/04
73-23-04	R	403	Jun01/10
73-23-04		404	Jun01/04
73-23-04		405	Jun01/04
73-23-04		406	Jun01/04
73-23-04		407	Jun01/04
73-23-04		408	Jun01/04
73-23-04		409	Jun01/04
73-23-04		410	Jun01/04
73-23-06		401	Jun01/04
73-23-06		402	Jun01/04
73-23-06		403	Jun01/04
73-23-06		404	Jun01/04
73-23-07		401	Jun01/04
73-23-07		402	Jun01/04
73-23-07		403	Jun01/04
73-23-07		404	Jun01/04
73-23-07		601	Jun01/04
73-23-07		602	Jun01/04
73-30-00		1	Jun01/04
73-30-00		2	Dec01/90
73-30-00		3	Jun01/07
73-30-00		4	Jun01/07

CH/SE/SU	C	PAGE	DATE
73-30-00		5	Jun01/07
73-31-00		1	Jun01/04
73-31-00		2	Jun01/04
73-31-00		3	Jun01/04
73-31-00		4	Jun01/04
73-31-00		5	Jun01/07
73-31-00		6	Jun01/04
73-31-00		7	Jun01/07
73-31-00		501	Jun01/07
73-31-11		401	Jun01/04
73-31-11		402	Jun01/04
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73-31-11		405	Jun01/04
73-31-11		406	Jun01/04
73-31-11		407	Jun01/04
73-31-21		401	Jun01/04
73-31-21		402	Jun01/07
73-33-00		1	Jun01/04
73-33-00		2	Jun01/04
73-33-00		3	Jun01/04
73-33-00		4	Jun01/04
73-33-11		401	Jun01/04
73-33-11		402	Jun01/04
73-33-11		403	Jun01/04
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73-34-00		4	Jun01/06
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73-34-00		901	Jun01/08
73-34-11		401	Jun01/04
73-34-11		402	Jun01/04
73-34-11		403	Jun01/04
73-34-11		404	Jun01/06
73-34-11		405	Jun01/06
73-34-11		406	Jun01/04

CHAPTER 73

ENG. FUEL & CONTROL

TABLE OF CONTENTS

SUBJECT	CH/SE/SU	C	PAGE EFFECTIVITY
GENERAL	73-00-00		
Description and Operation		1	001-100,
General		1	001-100,
Component Location		1	001-100,
Electrical Supply		1	001-100,
Operation		1	001-100,
Monitoring		7	001-100,
Control and Indicating		7	001-100,
FUEL DISTRIBUTION	73-10-00		
Description and Operation		1	001-100,
General		1	001-100,
Description		1	001-100,
FUEL PUMP	73-12-01		
Removal/Installation		401	001-100,
Inspection/Check		601	001-100,
Fuel Pump Inspection/Check		601	001-100,
Cleaning of Cartridge Strainer Element		601	001-100,
FILTER ELEMENT-FUEL	73-12-02		
Removal/Installation		401	001-100,
Inspection/Check		601	001-100,
FUEL FILTER	73-12-03		
Removal/Installation		401	001-100,
Inspection/Check		601	001-100,
MAIN FUEL SUPPLY LINE	73-12-04		
Removal/Installation		401	001-100,
Inspection/Check		601	001-100,
FUEL NOZZLES	73-13-01		
Removal/Installation		401	001-100,
Inspection/Check		601	001-100,
Cleaning/Painting		701	001-100,
FUEL SUPPLY MANIFOLDS	73-13-03		
Removal/Installation		401	001-100,
Inspection/Check		601	001-100,
COMBUSTOR DRAIN VALVE	73-13-04		
Removal/Installation		401	001-100,
Inspection/Check		601	001-100,
Visual Inspection		601	001-100,
Valve Actuation Check		601	001-100,
CONTROLLING	73-20-00		
Description and Operation		1	001-100,
General		1	001-100,
Description		1	001-100,

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIVITY
MAIN ENGINE CONTROL	73-21-01			
Removal/Installation			401	001-100,
Adjustment/Test			501	001-100,
Rigging of the VSV and VBV Feedback System			501	001-100,
Specific Gravity Adjustment			510	001-100,
Minimum Idle Speed Adjustment			511	001-100,
Inspection/Check			601	001-100,
Procedure			601	001-100,
Leakage Inspection/Check			601	001-100,
Electrical Resistance Inspection/ Check			602	001-100,
Approved Repairs			801	001-100,
COMPRESSOR INLET TEMPERATURE SENSOR	73-21-02			
Removal/Installation			401	001-100,
Inspection/Check			601	001-100,
N1 SPEED SENSOR (HYDRO-MECH)	73-21-07			
Removal/Installation			401	001-100,
POWER MANAGEMENT CONTROL	73-23-00			
Removal/Installation			401	001-100,
Adjustment/Test			501	001-100,
Operational Test			501	001-100,
PMC-Retrieving Non-Volatile Memory			503	001-100,
PMC-Retrieving Non-Volatile Memory (Alternate Procedure with PMC Maintenance Reader)			506	001-100,
PMC-Retrieving Non-Volatile Memory (Alternate Procedure with AIDS)			507	001-100,
Engine Rating Code in Correspondance with the Engine Model			508	001-100,
Inspection/Check			601	001-100,
POWER MANAGEMENT CONTROL (PMC) CABLES	73-23-04			
Removal/Installation			401	001-100,
INLET TEMPERATURE SENSOR	73-23-06			
Removal/Installation			401	001-100,
FAN INLET TEMPERATURE SENSOR	73-23-07			
Removal/Installation			401	001-100,
Inspection/Check			601	001-100,
INDICATING	73-30-00			
Description and Operation			1	001-100,
General			1	001-100,
FUEL FLOW INDICATING	73-31-00			
Description and Operation			1	001-100,
Fuel Flow Transmitter			1	001-100,
FF/FU Indicator			3	001-100,
Adjustment/Test			501	001-100,
FUEL FLOW TRANSMITTER	73-31-11			
Removal/Installation			401	001-100,

Printed in France

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIVITY
FUEL FLOW/FUEL USED INDICATOR	73-31-21			
Removal/Installation			401	001-100,
FUEL PRESSURE	73-33-00			
Description and Operation			1	001-100,
Fuel Pressure Transmitter			1	001-100,
Fuel Pressure Indicating			1	001-100,
FUEL PRESSURE TRANSMITTER	73-33-11			
Removal/Installation			401	001-100,
Deactivation/Reactivation			901	001-100,
FUEL FILTER CLOGGING	73-34-00			
Description and operation			1	001-100,
Adjustment/Test			501	001-100,
Deactivation/Reactivation			901	001-100,
Ref. : MMEL Sect. 1-73, ITEM 7 ("FUEL CLOG" lt.)			901	001-100,
Procedure			901	001-100,
Deactivation			901	001-100,
FUEL FILTER DIFFERENTIAL PRESSURE SWITCH	73-34-11			
Removal/Installation			401	001-100,

1. General (Ref. Fig. 001)

The engine fuel system enables delivery of a fuel flow corresponding to the throttle control lever position, and compatible with the engine operating limits (engine still on acceleration - deceleration).

The engine fuel system consists of :

- the fuel pump
- the fuel/oil heat exchanger
- the fuel filter
- the main engine control (MEC)
- the fuel flow transmitter
- the IDG fuel/oil heat exchanger
- the distribution lines
- the fuel nozzles.

The fuel pump, the heat exchanger and the filter form a single assembly located aft of the accessory gearbox 5 o'clock and opposite the main engine control.

The fuel pump, the oil pump and the MEC are driven by the HP compressor shaft at speed N = 0.584N2.

2. Component Location

(Ref. Fig. 002)

3. Electrical Supply

(Ref. Fig. 003)

4. Operation

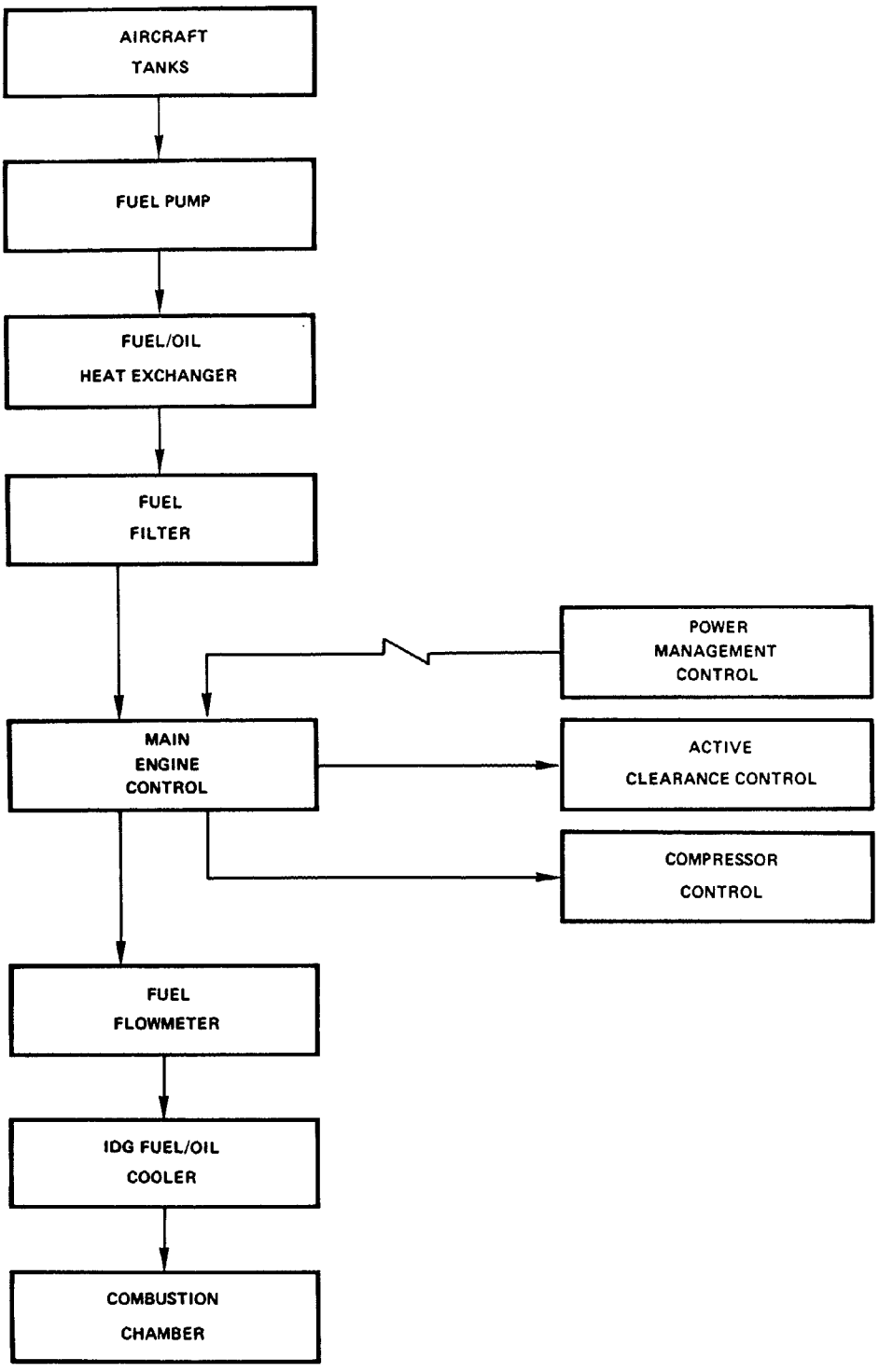
The fuel supplied from the fuel tanks flows through a centrifugal pump coupled with a gear HP pump protected by a filter. Fuel is then sent to the fuel/oil heat exchanger and to the main engine control (MEC) protected by a filter.

The MEC is a hydromechanical component. It elaborates a certain number of reference pressures which are applied to the various fuel manifolds to produce :

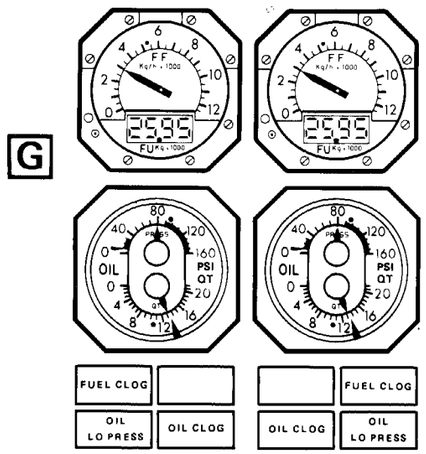
- the fuel flow to be supplied to the fuel nozzles
- the positions of HP compressor variable stator vanes (VSV)
- the positions of variable by-pass valves (VBV) with respect to exterior conditions.
- the limits required by the engines and the throttle control lever position.
- turbine case cooling and active clearance control.

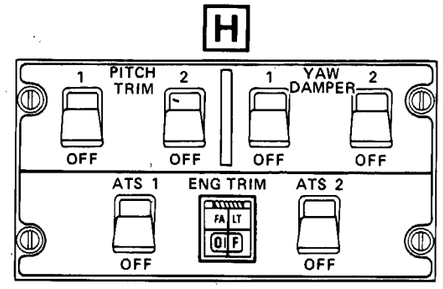
The following components are located downstream of the MEC :

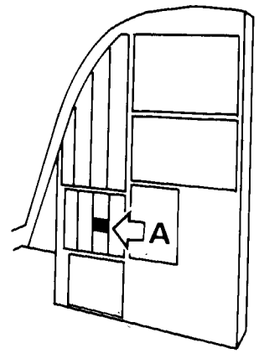
- the pressurizing and shutoff valve, electrically controlled from the control lever on the center pedestal. It is located downstream of the metering valve and enables cutoff of the fuel supply to the fuel nozzles. The valve also provides correct pressurization of fuel supplied to the fuel nozzles to ensure proper spray into the combustion chamber.
- the fuel flow transmitter which meters the fuel flow to the fuel nozzles and transmits a signal to the fuel flow/fuel used (FF/FU) indicator on center instrument panel.
- the IDG fuel/oil heat exchanger allows the IDG oil temperature to be main-

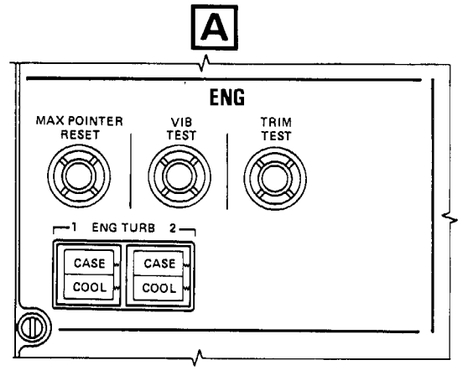


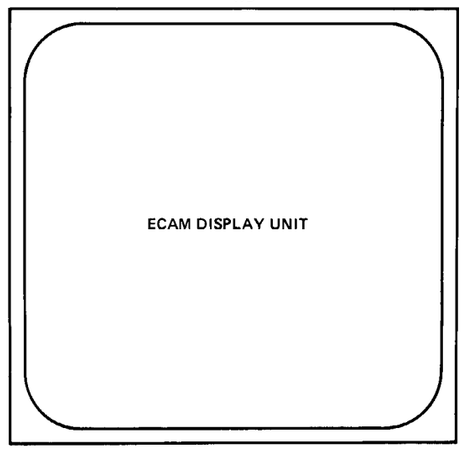
Fuel System Block Diagram
Figure 001

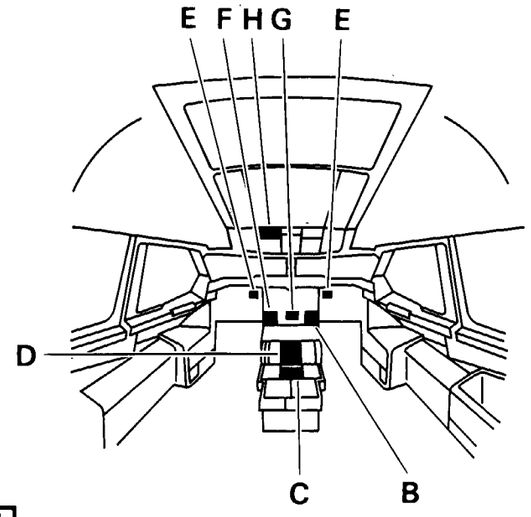


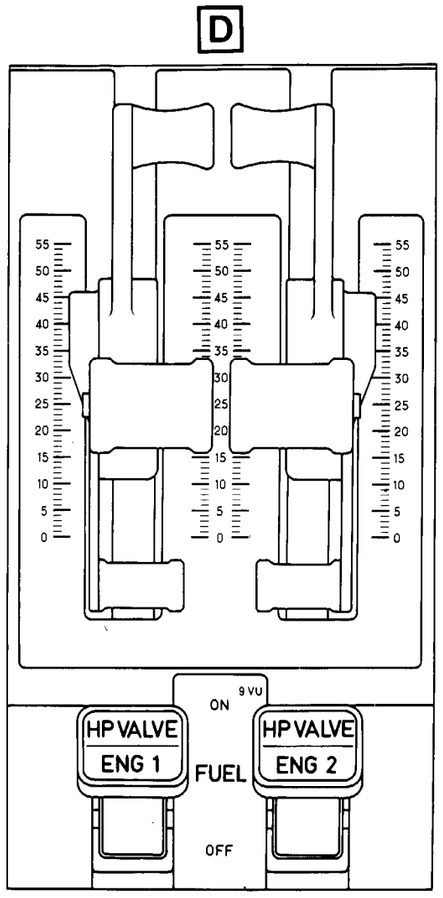


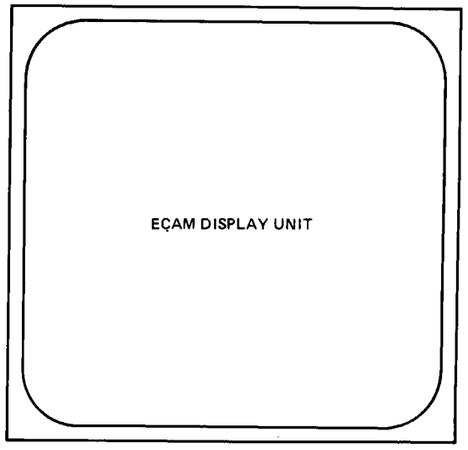


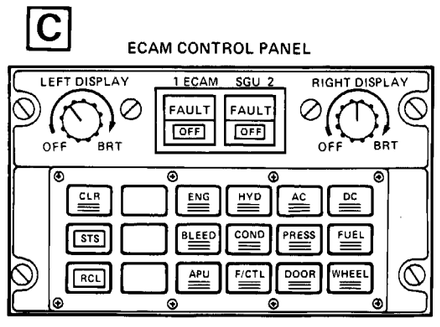


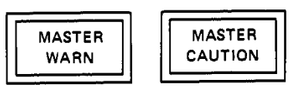






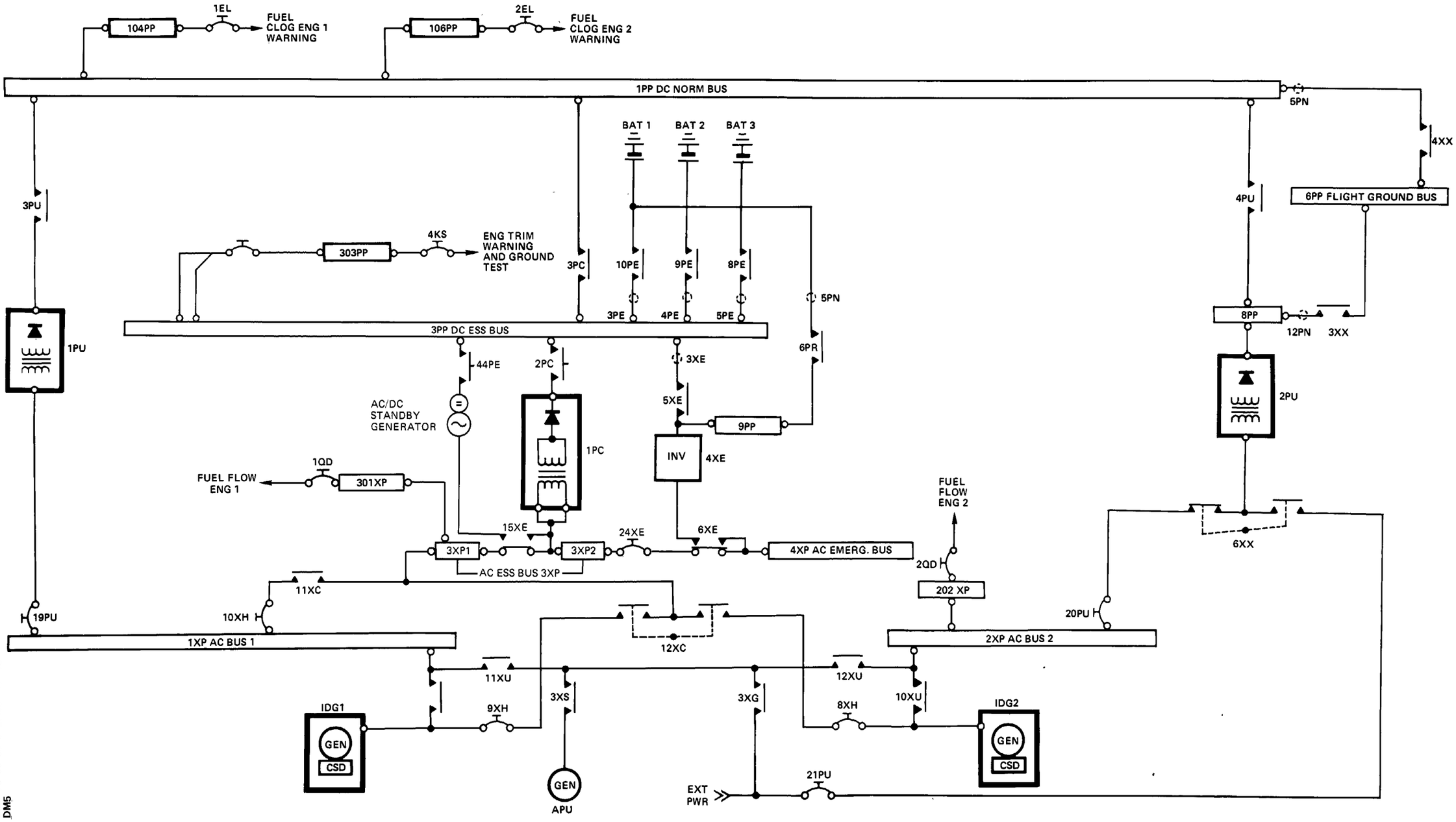






BM5 73 00 00 0 LGGO 20 15
DM5

Component Location - Controls and Indications
Figure 002



ENG1/ENG2 FUEL SYSTEM - ELECTRICAL SUPPLY
Figure 003

tained within the normal operating range.
- thirty fuel nozzles which distribute fuel into the combustion chamber so as to ensure proper spray and supply a mixture sufficiently rich to achieve :
- a correct ignition within the relight range
- a correct stability of the flame within the operating range.

5. Monitoring
(Ref. Fig. 004)
The engine fuel system is monitored from :
- the center instrument panel
- the **ECAM** display unit and by means of the local **FUEL CLOG** caution light associated with the **MASTER CAUTION** light on panel **3VU (5VU)**.

The center instrument panel is provided with the **FUEL FLOW/FUEL USED** indicator and with the **FUEL CLOG** amber caution light indicating fuel filter clogging at its early stage.
The **ENGINE** page on the **ECAM** display unit gives the pressure in the pump intermediate stage.

6. Control and Indicating
(Ref. Fig. 005)
(Ref. Fig. 006)
(Ref. Fig. 007)
(Ref. Fig. 008)
(Ref. Fig. 009)

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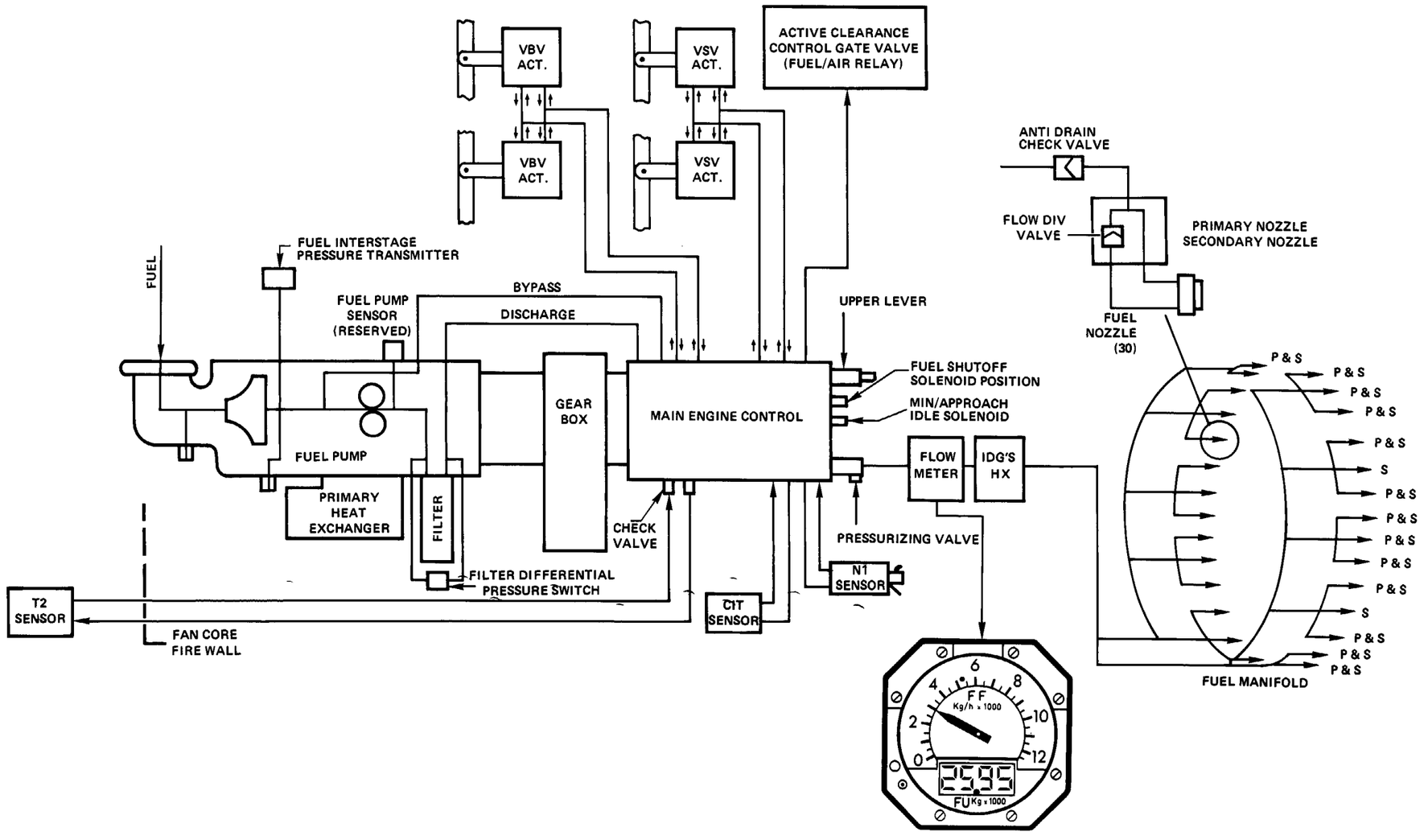

BM5 73 00 00 0 LRMO-14-09
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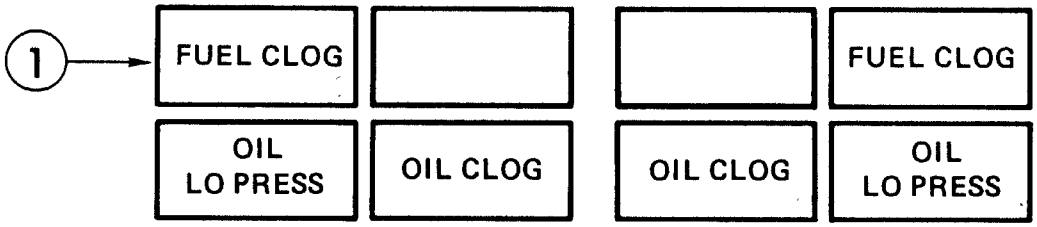
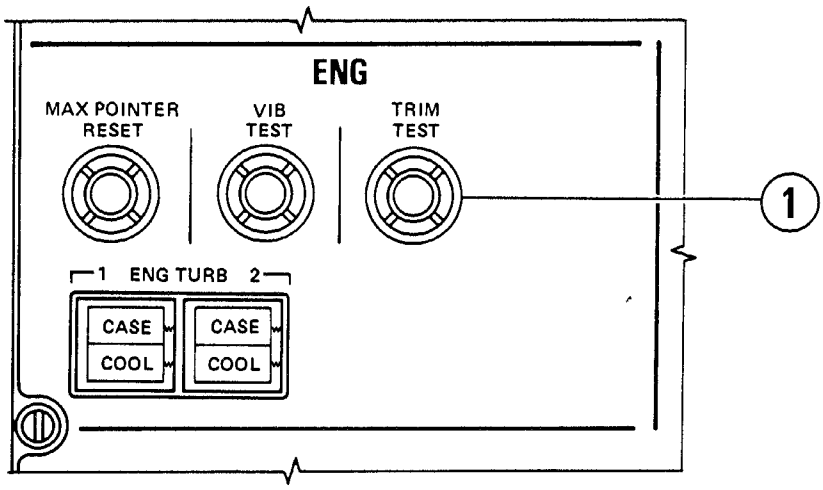
Fuel System Monitoring - Schematic
Figure 004



1 - FUEL CLOG WARNING LIGHT (AMBER)
COMES ON WHEN FUEL FILTER DIFFERENTIAL
PRESSURE EXCEEDS 23 PSI
ACCOMPANIED BY MASTER CAUTION LIGHT
AND SINGLE CHIME
ENGINE PAGE APPEARS ON RIGHT ECAM DISPLAY UNIT

BM5 73 00 00 0 LDGO-20-15
DM5

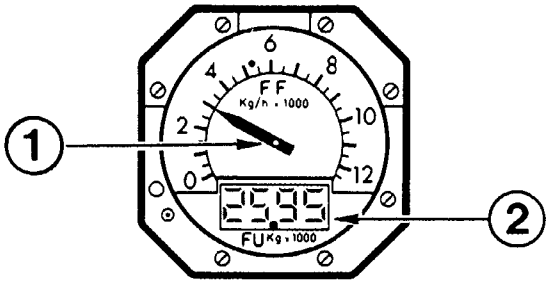
FUEL CLOG Warning Light
Figure 005



1. TRIM TEST PUSHBUTTON SWITCH
WHEN PRESSED ALLOWS POWER MANAGEMENT CONTROL SYSTEMS OF BOTH ENGINES TO BE TESTED.

BM5 73 00 00 0 LFGO - 21 - 15
DM5

TRIM TEST Pushbutton Switch
Figure 006

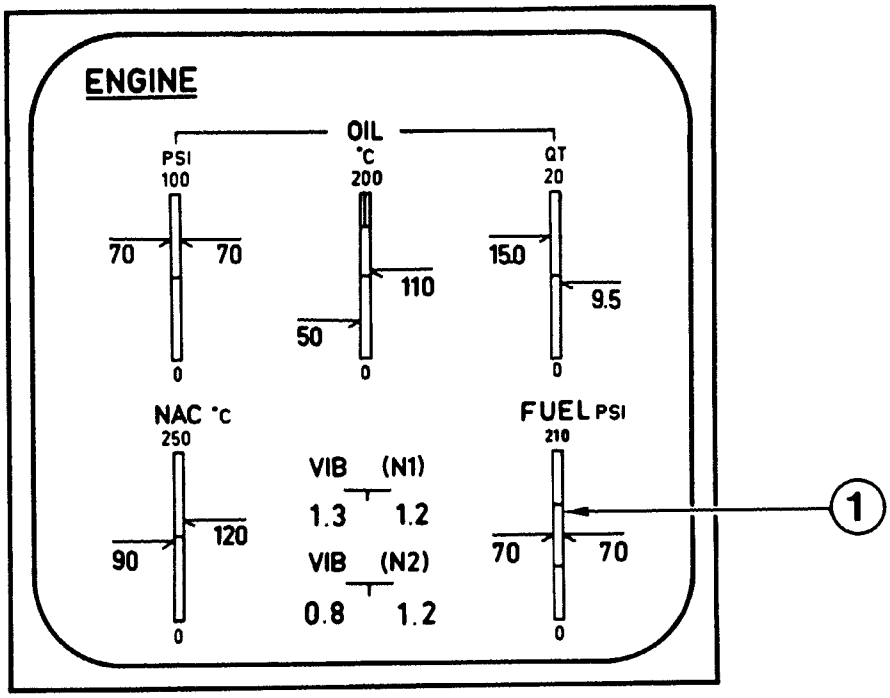


FUEL FLOW/FUEL USED (FF/FU) INDICATOR

1. POINTER INDICATES INSTANTANEOUS FUEL FLOW IN KG/H x 1000
   IN CASE OF SIGNAL FAILURE, OR IF THE INDICATOR IS NOT POWERED, SHOWS ZERO.
2. DIGITAL COUNTER · INDICATES FUEL USED IN KG x 1000
   IF THE INDICATOR IS NOT POWERED, SHOWS BLACK
   IN CASE OF SIGNAL FAILURE, SHOWS - - - -
   DURING LIGHT TEST INDICATION IS 8888

BM5 73 00 00 0 LTMO · 13 · 07
DM5

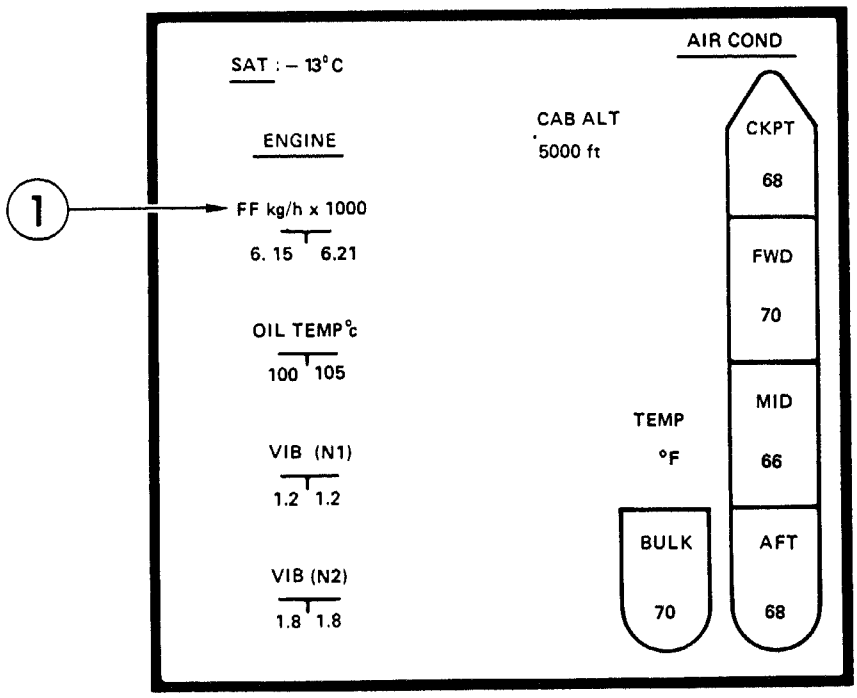
Fuel Flow/Fuel Used Indicator
Figure 007



1. FUEL PRESSURE

BM5 73 00 00 0 LVMO 14 09
DM5

Fuel Pressure Indications (R ECAM Display Unit)
Figure 008



CRUISE PAGE

1 - FUEL FLOW (G)

BM5 73 00 00 0 LXNO - 25 - 18
DM5

Cruise Page
Figure 009

FUEL DISTRIBUTION - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 002, 003)
(Ref. Fig. 001)
The main components of the fuel distribution system are :
- the fuel supply line
- the fuel pump
- the main engine control (MEC)
- the fuel flow transmitter (Ref. 73-31-00)
- the IDG fuel/oil heat exchanger
- the fuel manifold
- the fuel nozzles.

Pre SB GE 73-253*** (Engines with a drain manifold)
- the drain manifold

End Pre SB GE 73-253

The fuel supply is connected to the fluids junction box attached under the core engine pylon, R side. The fuel supply is routed along the compartment cooling air pipe and supplies fuel to the fuel pump assembly (Ref. 73-12). This fuel must comply with the GE D 50TF2 specification (more specifically the fuels to be used are those complying with the ASTM D1655 and MIL T 5524 specification with addition of antimicrobial agent Biobor JF at 270 ppm.).
Fuel flows through the fuel pump, the fuel/oil heat exchanger and the filter. It is then metered by the main engine control (MEC) which determines the quantity to be sent to the fuel nozzles via the HP fuel shut off valve, the fuel flow transmitter, and the IDG fuel/oil heat exchanger.

Pre SB GE 73-253*** (Engines with a drain manifold)
There is a drain system to prevent any fuel leakage onto hot surfaces at the fuel manifold to fuel nozzle interfaces.

End Pre SB GE 73-253

2. Description

A. Fuel Pump (Ref. Fig. 004)

The fuel pump assembly is located aft of the accessory gearbox at 5 o'clock. It is driven by the HP compressor shaft at speed N = 0.584N2; this single shaft is lubricated by fuel and has a break point.
Fuel from the fuel tanks flows through the centrifugal boost element. The fuel flow is sent towards the HP gear element after flowing through a 250 microns-mesh debris screen. When the pressure drop through the HP screen reaches 4 psid, the screen applies pressure to spring and causes an orifice to open which enables non-filtered fuel to flow to the high pressure gear element. This orifice opens fully at pressure 1.1 bar (16 psid).
From the high pressure gear element, fuel is directed to fuel/oil heat exchanger and fuel filter before flowing to the MEC. When the pressure drop between the inlet and outlet of the HP fuel pump reaches 107 bars (1550 psid) a high pressure relief valve opens which enables return of fuel towards the HP pump debris screen; this pressure relief valve opens fully at 110 bars (1600 psid).
The excess fuel flow from the MEC is recycled to the HP pump debris screen.

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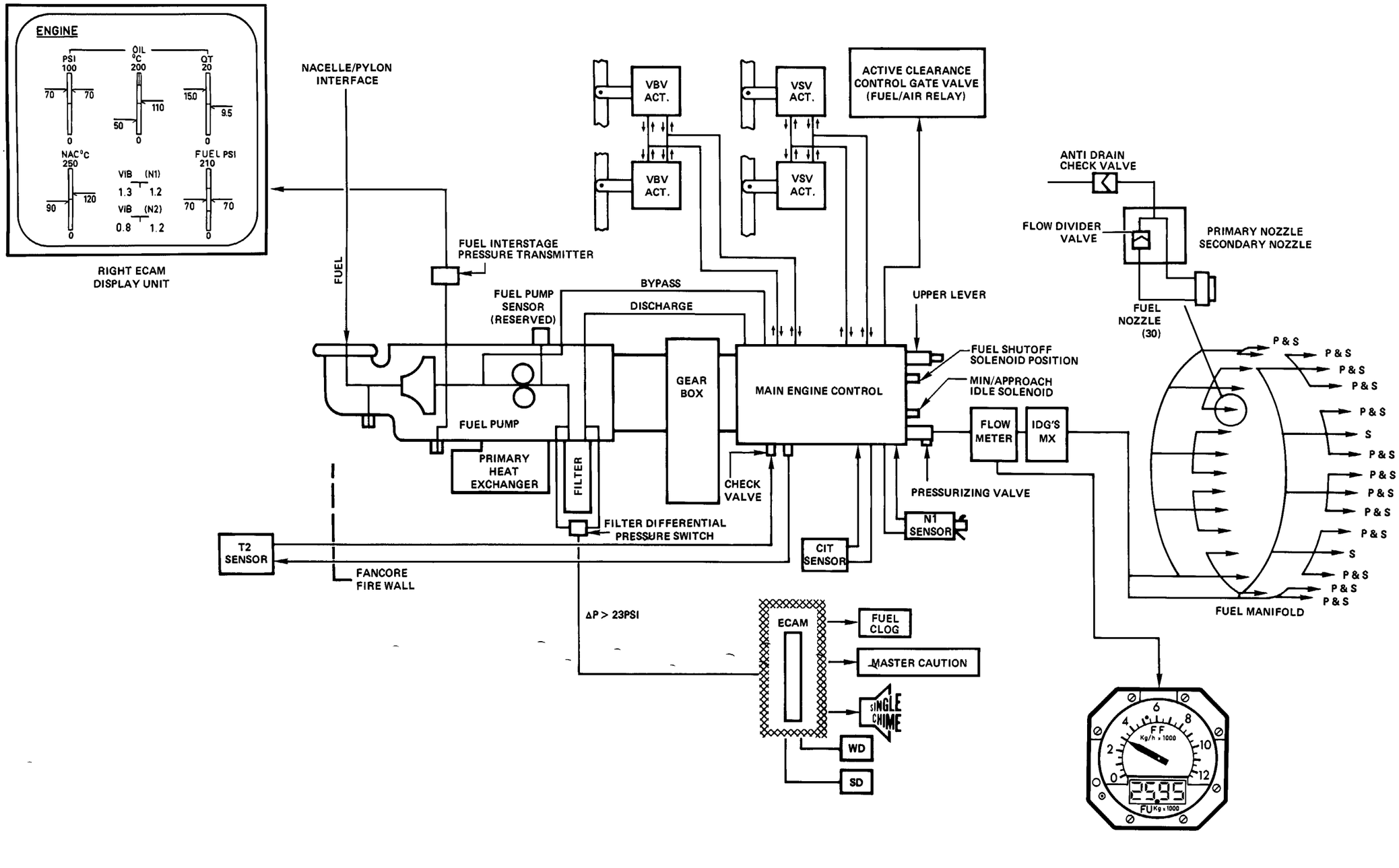

BM5 73 10 00 0 LCMO 14 09
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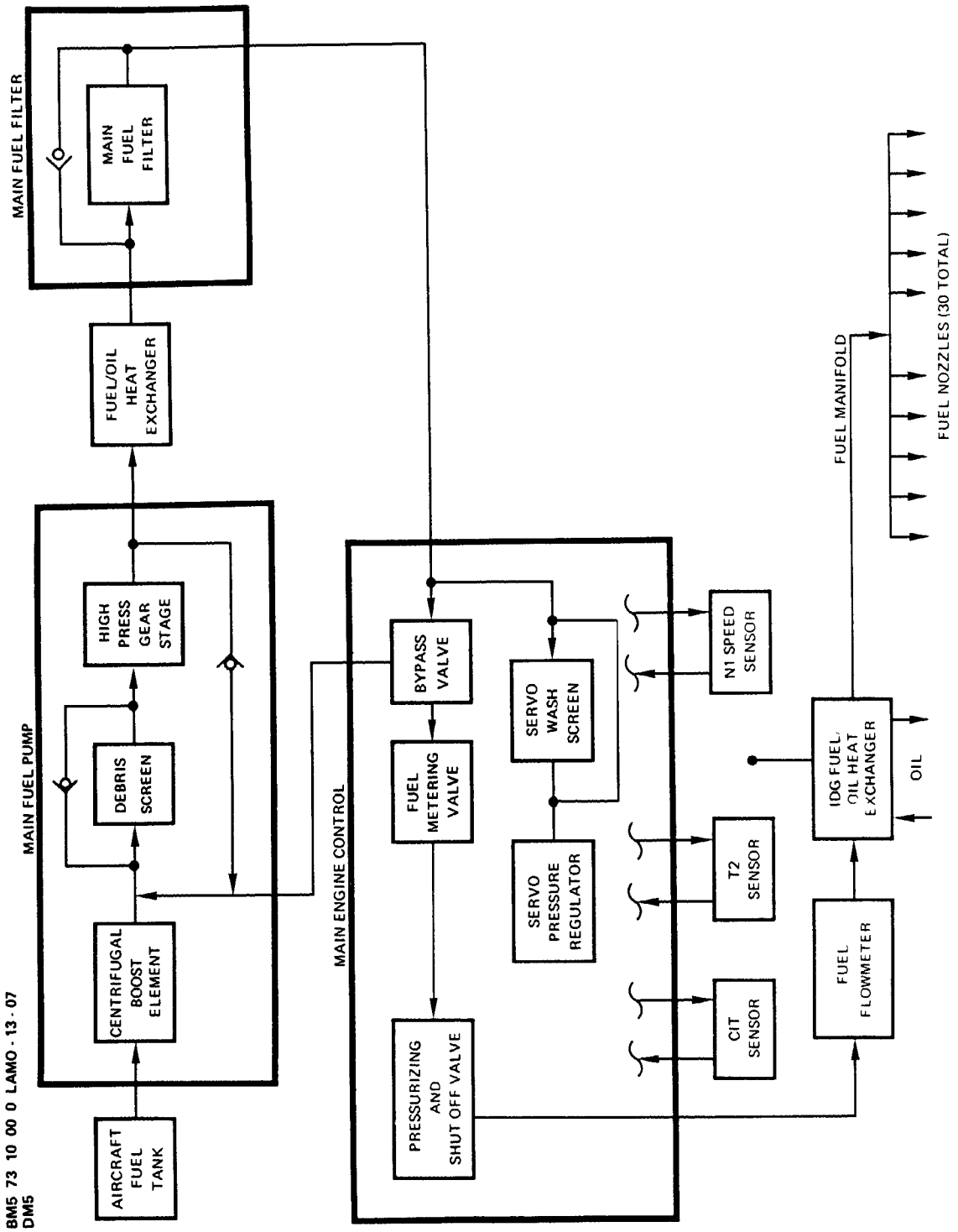
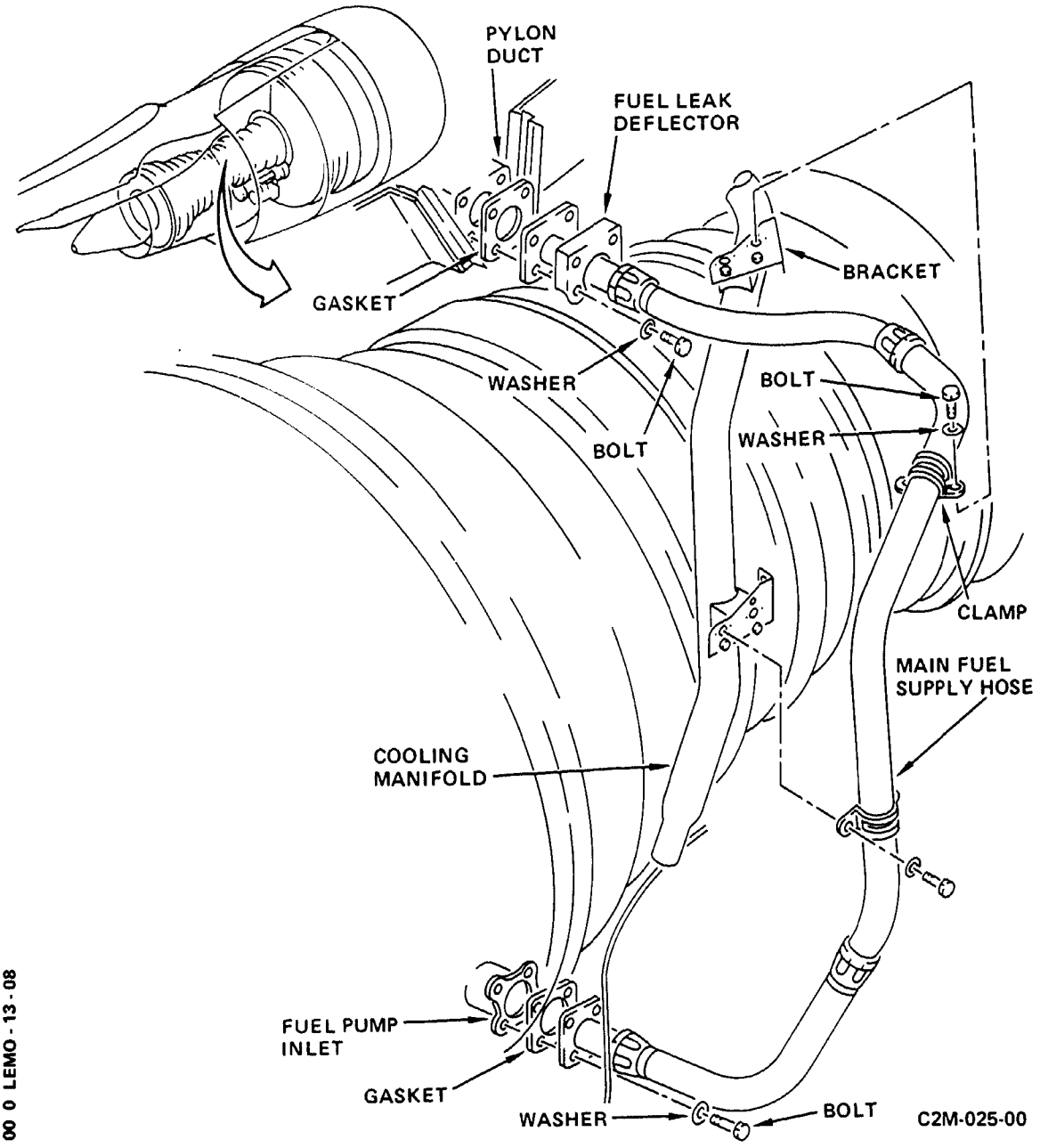
Fuel System Schematic
Figure 001



Fuel System Block Diagram
Figure 002



BM5 73 10 00 0 LEMO-13-08
DM5

Engine Fuel Supply
Figure 003

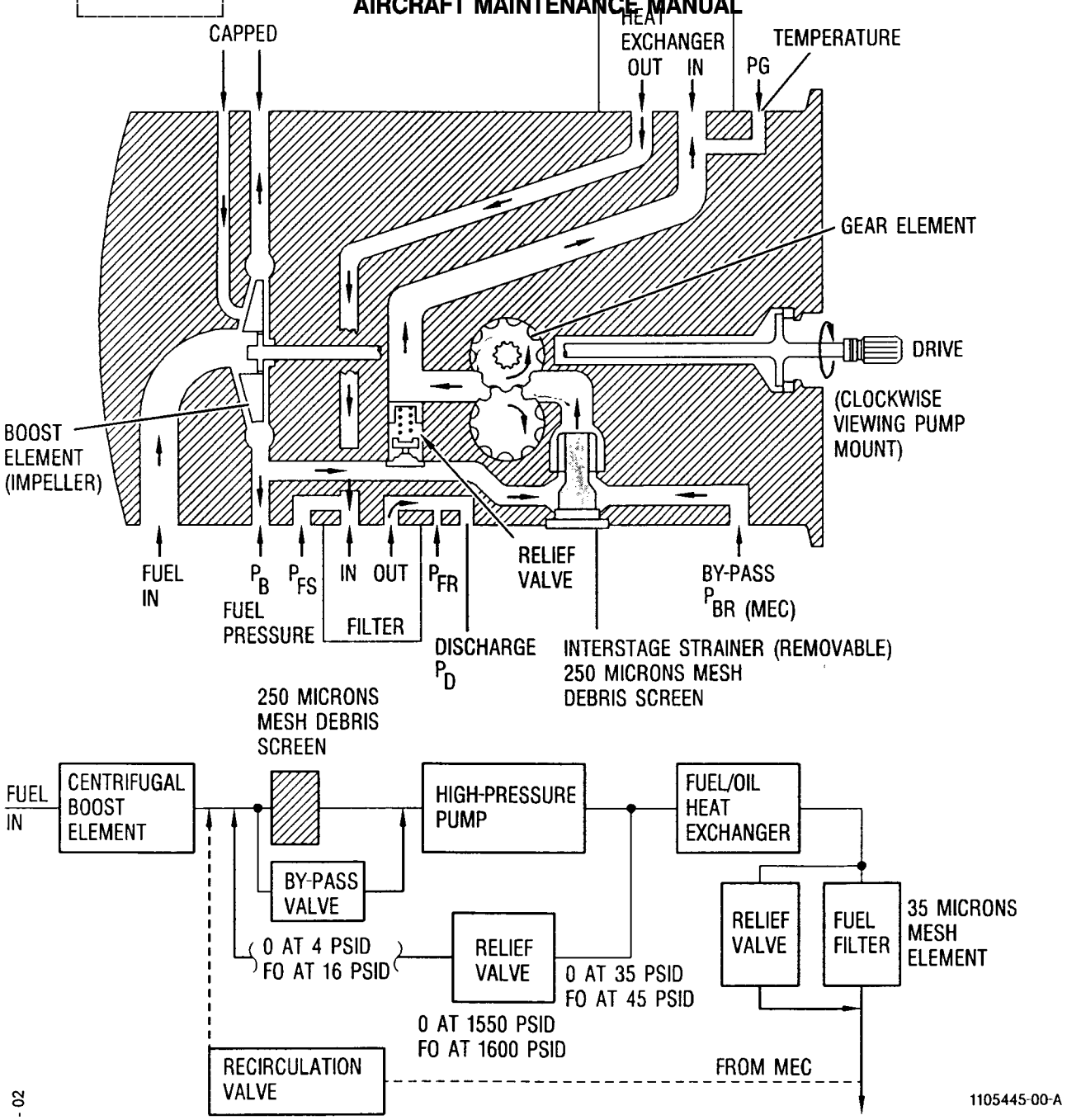
The following components are installed on the pump body :
- the fuel/oil heat exchanger
- the fuel filter
- the fuel pressure transmitter

B. Fuel/Oil Heat Exchanger (Ref. Fig. 005)
The function of the fuel/oil heat exchanger is to maintain an adequate oil temperature within all the operating configurations.
To this effect, the fuel temperature is increased. This fuel temperature must remain within certain limits : 1.7°C (35°F) to 143°C (289°F) to prevent fuel icing and fuel pump cavitation. The oil flows around the fuel pipes. During cold starting the heat exchanger undergoes a high pressure drop due to the oil viscosity. An oil pressure relief by-pass valve cracks open when Δp reaches 5.86 bars (85 psid) and is fully open when Δp is 6.9 bars (100 psid) which enables direct passage of oil from the inlet to the outlet of the heat exchanger without the oil flowing through it; then the oil returns to the oil tank.

C. Fuel Filter (Ref. Fig. 006)
The fuel filter is installed on the fuel pump. It consists of a 35 microns mesh filter element which ensures nominal filtering of 10 microns.
It prevents dirt from entering the MEC.
The filter element is easily removed for inspection, cleaning/replacement as required.
The fuel filter is provided with a relief valve which cracks open when the pressure drop in the filter reaches 2.41 ± 0.35 bars (35 ± 5 psid). This relief valve is fully open when pressure drop is 3.1 bar (45 psid).

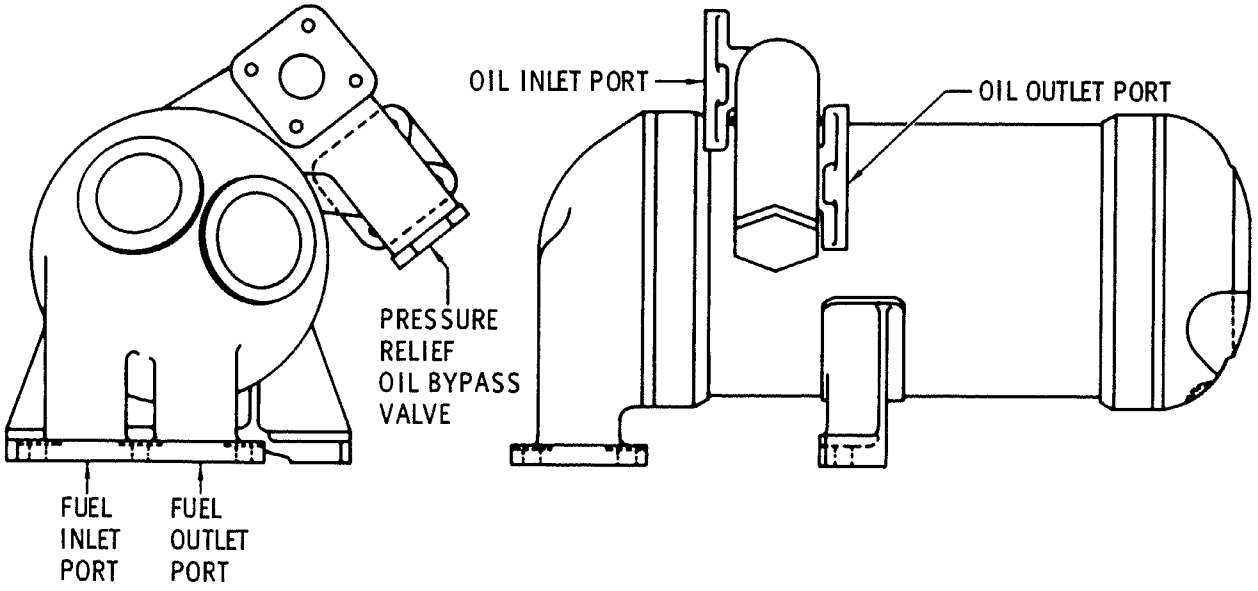
D. Main Engine Control (Ref. Fig. 007)
Fuel flow is controlled by means of various components located in the MEC :
- the HP fuel shut off and pressurizing valve
- the recirculation valve
- the metering valve

Recirculation Valve (Bypass Valve)
The HP fuel pump delivers a given flow of fuel metered by the metering valve. The excess fuel not flowing across the metering valve is recycled through the recirculation valve.
It is reinjected into the fuel pump between the centrifugal boost element and the HP pump debris screen. The function of the recirculation valve is to optimize the fuel/oil heat exchanger efficiency on an engine rating reduction.
The fuel flowing through this recirculation valve can be regulated with respect to the density of fuel used. This bypass valve is able to bypass 16013 kg/h (36,000 pph) so that the minimum flow requirements can be met.
Metering Valve.
The fuel metering valve meters the quantity of fuel to be injected. This fuel quantity is computed and optimized by the MEC and the PMC. Various parameters are required for this computation : PLA, N1, N2, POC, T2, CIT, CDP, the electrical signal from the PMC to the MEC torque motor, the electrical signal controlling the flight/ground idle.
The metering valve is provided with stops so as to obtain a maximum and



BM5 73 10 00 0 LGMO - 02

Fuel Pump-Schematic
Figure 004



BM5 73 10 00 0 LJMO - 15 - 10
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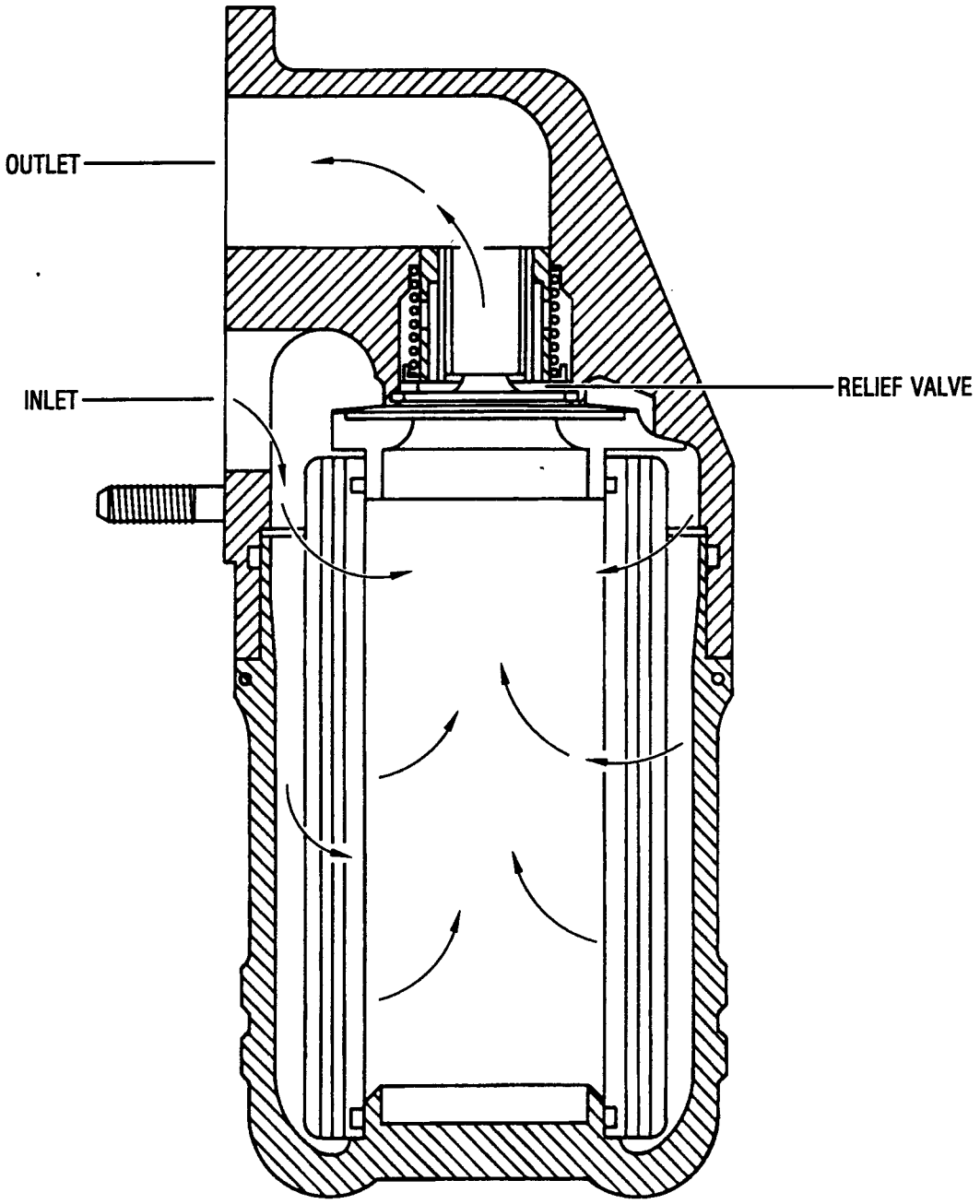
Fuel/Oil Heat Exchanger
Figure 005



BM5 73 10 00 0 LLMO - 02

Fuel Filter
Figure 006

minimum fuel flow.
The minimum fuel flow for operation is 256 to 274 kg/h (576 to 612 PPh)
The maximum fuel flow is 11565 ot 12455 kg/h (26,000 to 28,000 pph)
Pressurizing and Shutoff Valve (Ref. Fig. 008).
This valve is mounted downstream of the metering valve and upstream of the fuel nozzles.
The shutoff action is controlled by an electrically operated latching solenoid valve. An aircraft supplied electrical signal positions the solenoid valve to open or close the pressurizing valve. When the solenoid position is calling for fuel shutoff, fuel pressure is ported to both sides of the pressurizing valve and the spring in the pressurizing valve forces the piston to shuttle to shutoff fuel flow. When the solenoid calls for an open position, fuel pressure to downstream of the pressurizing valve is reduced and system HP fuel pressure overpowers the spring pressure and allows fuel flow.
Its pressurizing function is to keep the fuel supply pressure to a satisfactory value : 240 to 300 psi (above the bypass pressure) to ensure correct spray of fuel by the nozzles in all operating configurations.

E. IDG Fuel/Oil Heat Exchanger
(Ref. 24-11-00, P. Block 1)

F. Fuel Manifold
Pre SB GE 73-253*** (Engines with a drain manifold)
The fuel manifold is made of two manifold halves which are around the right and left engine core section. Each manifold half has a fuel manifold supply tube, a drain manifold, a fuel manifold, and fuel tubes and drain shrouds to each fuel nozzle. A shroud is around each fuel tube to carry leakage overboard. The two manifold halves are fastened together at the 11 and 5 o'clock positions and held by support brackets and clamps.
End Pre SB GE 73-253
Post SB GE 73-253*** (Engines without a drain manifold)
The fuel manifold is made of two manifold halves which are around the right and left engine core section. Each manifold half has a fuel manifold supply tube, a fuel supply manifold, fuel nozzle supply tubes, and fuel nozzle shrouds to each fuel nozzle. The two manifold halves are fastened together at the 11 and 5 o'clock positions and held by support brackets and clamps.
End Post SB GE 73-253

G. Fuel Nozzles (Ref. Fig. 009)
The thirty fuel nozzles are all primary-secondary types.
The two sets of special primary-secondary designs are as follows :
- Positions 9 and 13 : Nozzles at the igniters have special low-flow primary orifices to facilitate altitude restarting. The secondary circuit is compensated to maintain high-power flow rate identical to all other nozzles.
- Positions 15 and 16 : Nozzles have low-power enrichment to provide a "pilot" flame source on decel to prevent flame-out. This is achieved by controlled leakage through the flow-divider valve. High-power flow is also maintained identical to all other nozzles.

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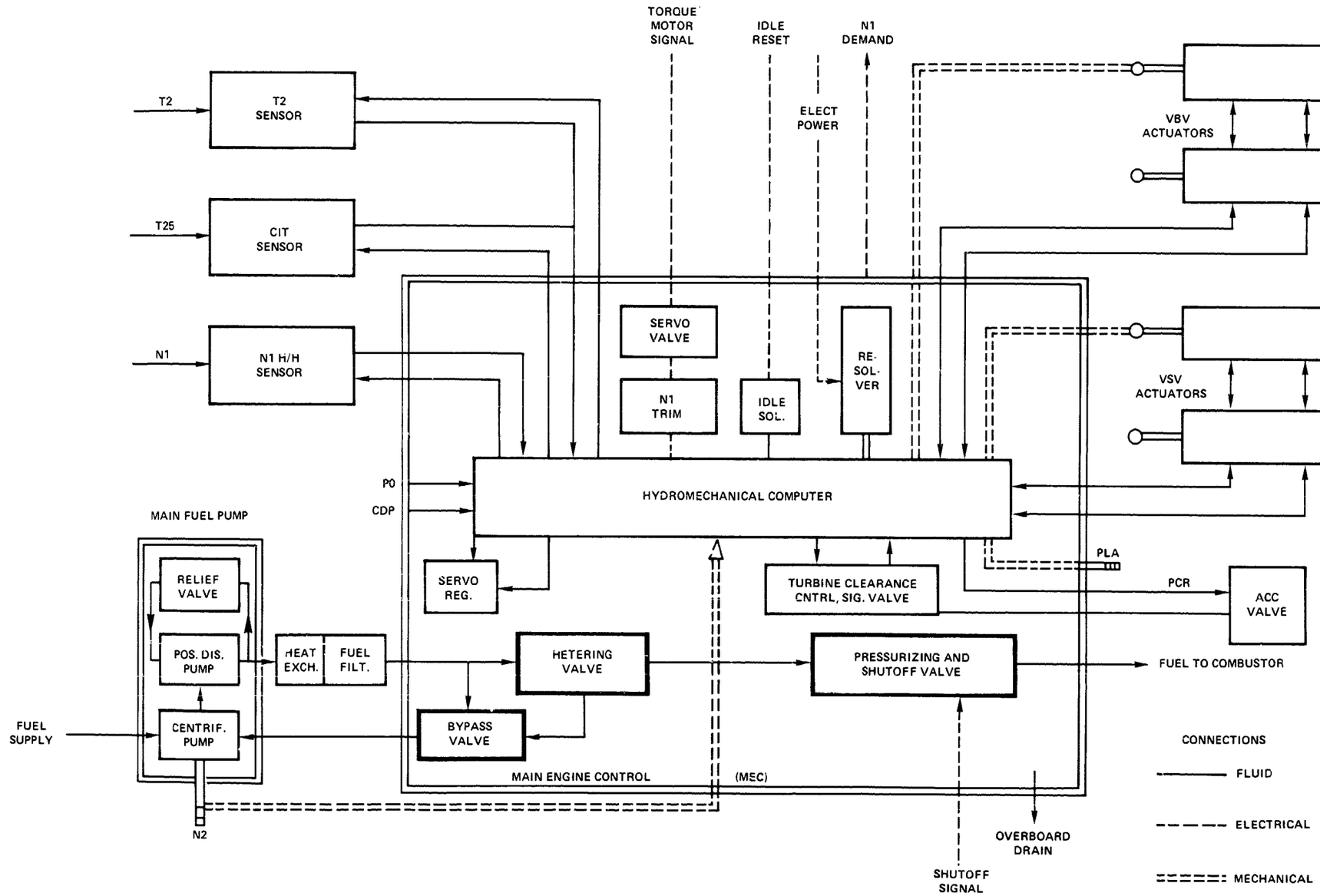

BM5 73 10 00 0 LNMO - 13 - 07
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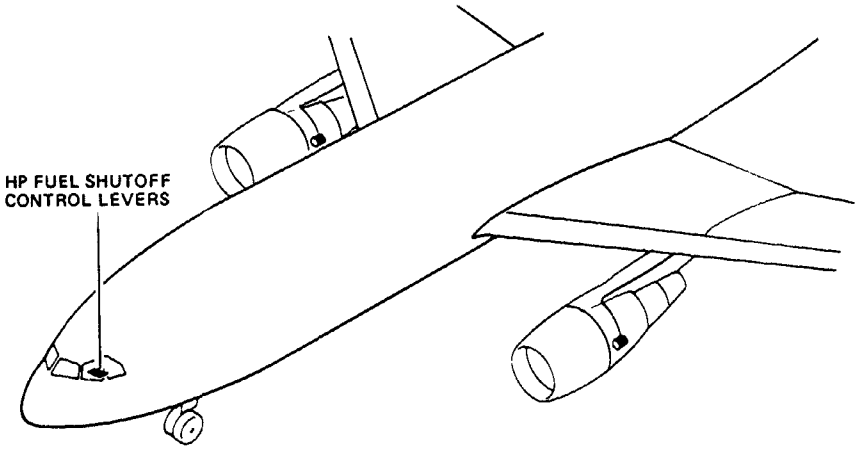
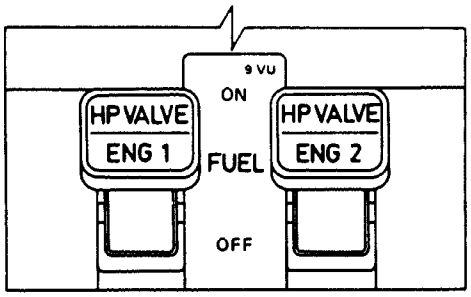
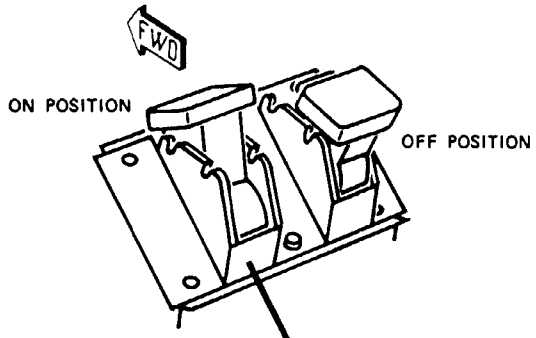
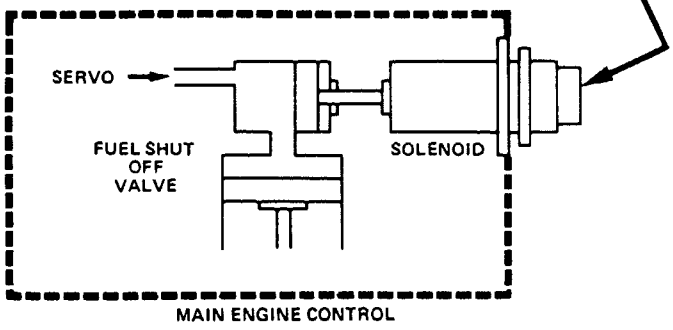
Fuel System Control
Figure 007









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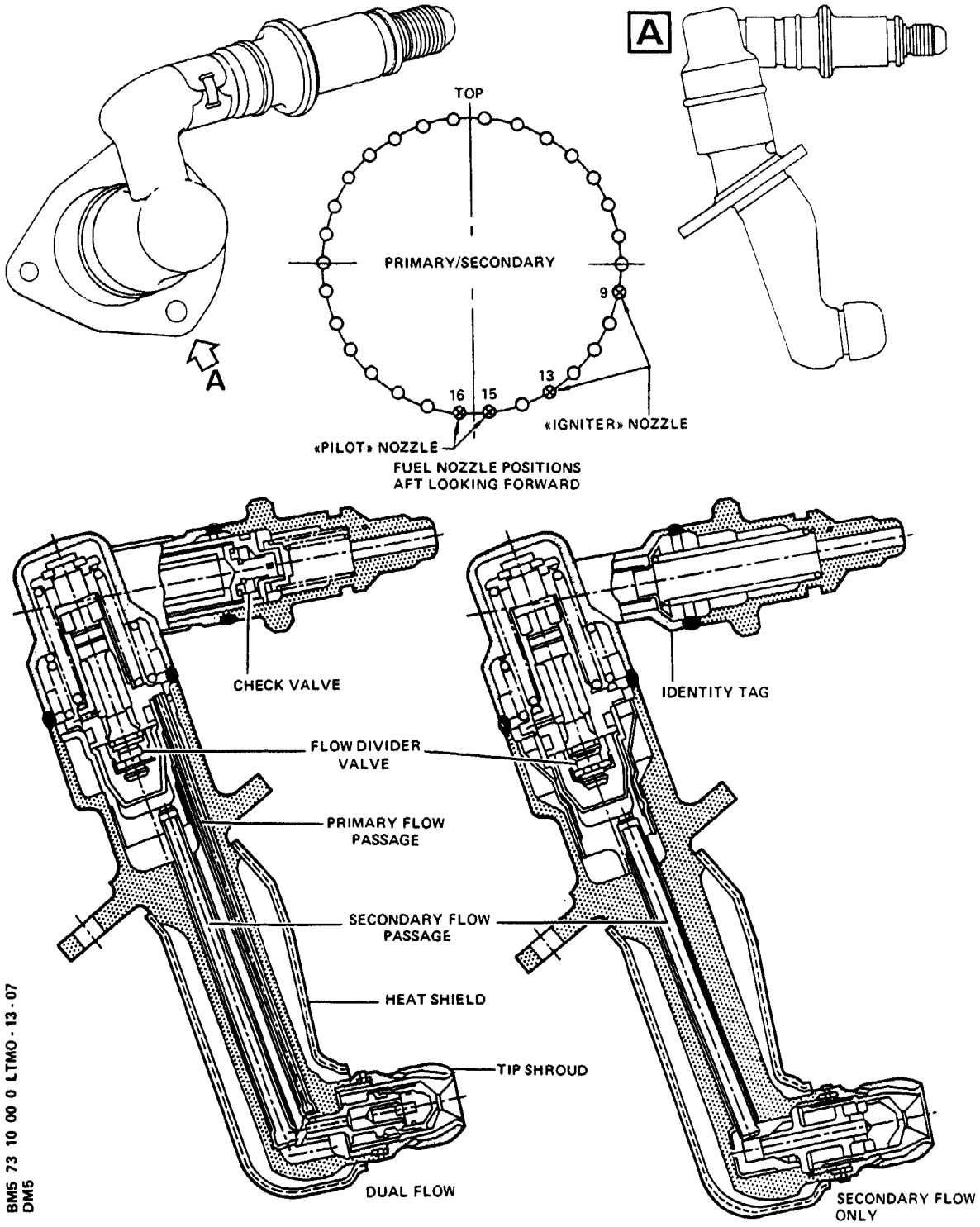
HP Fuel Shutoff System
Figure 008



Fuel Nozzles
Figure 009

FUEL PUMP - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A. Material No.C02-019	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
B. Material No.C02-021	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
C. Material No.C02-058	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
D.	Container 5 US GAL (19 l)
E.	Caps and Plugs
F.	Gasket
G.	Torque Wrench 10 - 150 lbf. in. (0.11 - 1.70 m.daN)
H.	Corrosion Resistant Steel Lockwire (Ref. 70-00-00)
Referenced Procedures	
- 28-24-00, P. Block 1	LP Fuel Fire Shut Off Control
- 71-00-00, P. Block 501	Power Plant
- 71-13-00, P. Block 301	Cowl Doors
- 73-12-01, P. Block 601	Fuel Pump
- 73-12-03, P. Block 401	Fuel Filter
- 73-33-11, P. Block 401	Fuel Pressure Transmitter
- 73-34-11, P. Block 401	Fuel Filter Differential Pressure Switch
- 79-22-02, P. Block 401	Fuel/Oil Heat Exchanger

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
133VU	ENG 1 & 2/START/CTL &/WARN	1KG	335/R68
133VU	ENG 1 & 2/IGNITION/SYS A	1JH	334/S72
133VU	ENG 1 & 2/IGNITION/SYS B	2JH	333/T72
133VU	ENG 1/REVERSE/CTL	1KM	332/U69
133VU	ENG 2/REVERSE/CTL	2KM	331/V74
133VU	ENG 1 & 2/FIRE EXTING/SQUIB A/BTL 1	1WE	335/R71
133VU	ENG 1 & 2/FIRE EXTING/SQUIB A/BTL 2	3WE	335/R72
22VU	FIRE EXTING/ENG 1 & 2/SQUIB B/BTL 1	5WE	207/C19
22VU	FIRE EXTING/ENG 1 & 2/SQUIB B/BTL 2	7WE	207/C20

(2)On overhead panel, pull ENG 1 (2) FIRE handle (Ref. 28-24-00, P. Block 1).

(3)Open fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).

B. Removal of Fuel Pump (Ref. Fig. 401)

NOTE : Keep gaskets for use when accessories are reinstalled. Install a protective cover at all openings. Discard used preformed packings.

CAUTION : SHUT OFF FUEL SUPPLY TO ENGINE PRIOR TO FUEL PUMP REMOVAL. FUEL SYSTEM WILL DRAIN IF NOT SHUT OFF.

(1)Remove lockwire, and remove inlet drain plug from fuel pump ; drain remaining fuel into container. Install plug, and TORQUE to between 130 and 150 lbf.in. (1.47 and 1.69 m.daN) and wirelock.

(2)Remove fuel pressure transmitter (Ref. 73-33-11, P. Block 401).

(3)Remove the fuel pump discharge tube attached to the fuel pump and the MEC adapter pad by removal of the eight bolts. Discard the gaskets.

(4)Remove the fuel return tube attached to the fuel pump and the MEC adapter pad by removal of the eight bolts. If equipped with condition monitoring, remove the bracket from the forward boltholes. Discard the gaskets.

(5)Do an inspection of the fuel pump locking inserts (Ref. 73-12-01, P. Block 601).

(6)Remove the four bolts and washers and disconnect the fuel inlet hose from the inlet port.

(7)Remove heat exchanger (Ref. 79-22-02, P. Block 401).

WARNING : FUEL PUMP WEIGHT IS APPROXIMATELY 43 LBS (19.5 KG). IMPROPER HANDLING COULD RESULT IN BODILY INJURY.

CAUTION : SUPPORT FUEL PUMP DURING REMOVAL TO PREVENT SPLINE DAMAGE. DO NOT PERMIT PUMP TO REST ON DRIVE SHAFT.

(8)Loosen nut of coupling clamp, disengage clamp, and remove fuel pump with fuel filter attached. Discard preformed packings.

(9)Remove fuel filter differential pressure switch (Ref. 73-34-11, P. Block 401).

(10)Remove the tube nipple and reducer fitting from the upper and lower fuel filter differential pressure switch ports in the fuel pump. Discard preformed packings and keep tube nipple and reducer fitting to use again.

(11)Remove fuel filter (Ref. 73-12-03, P. Block 401).

C. Installation of Fuel Pump (Ref. Fig. 401)

NOTE : Fuel components that have Fluorocarbon (Viton) external seals (SB 73-079) can leak for a short period of time when they are below -29°F (-34°C). If a leak occurs, continue the start to idle.
- If the fuel leakage stops in less than 5 minutes at idle, continue operation of the engine.
- If the fuel leakage continues after 5 minutes at idle, shut down the engine and repair the source of the leakage.

NOTE : Before installing pump, check gaskets for nicks, cuts, and gouges across sealing surface. Make sure seating material is not hard or brittle. Replace if defective. Lubricate preformed packing lightly with Material No.C02-021.

Pre SB GE 73-175

(1)Do the inspection of the fuel pump locking inserts (Ref. 73-12-01, P. Block 601).

End Pre SB GE 73-175

(2)Lightly coat new preformed packing with Engine Oil (Material No.C02-021) and install on the tube nipple.

(a)Install the tube nipple into the upper fuel filter differential

pressure switch port in the fuel pump.
(b)TORQUE to between 135 and 155 lbf.in. (1.53 and 1.75 m.daN).
(3)Lightly coat new preformed packing with Engine Oil (Material No.C02-021) and install on the reducer fitting.
(a)Install reducer fitting into the lower fuel filter differential pressure switch port in the fuel pump.
(b)TORQUE to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
CAUTION : MAKE SURE WASHERS ON STUDS ARE NOT TRAPPED BETWEEN FILTER FLANGE AND PUMP.
(4)Install fuel filter (Ref. 73-12-03, P. Block 401).

(5)Install fuel filter differential pressure switch (Ref. 73-34-11, P. Block 401).
WARNING : ASSEMBLY WEIGHT IS APPROXIMATELY 43 LBS (19.5 KG).
CAUTION : SUPPORT ASSEMBLY DURING INSTALLATION. CAREFULLY ALIGN PUMP TO GEARBOX TO PREVENT SPLINE DAMAGE.
(6)Place a preformed packing into fuel pump mounting flange groove and a preformed packing into groove of drive spline. Mount fuel pump onto its pad on the forward left side of the accessory gearbox aligning pin with hole. Secure with coupling clamp. TORQUE coupling clamp nut three times to between 115 and 125 lbf.in. (1.30 and 1.41 m.daN). Lightly hit the perimeter of the coupling with a soft-faced mallet while the coupling nut is torqued.
NOTE : Ensure that seal is installed in adapter pad before installation of pump.
(7)Install heat exchanger (Ref. 79-22-02, P. Block 401).
(8)Connect the fuel inlet hose to the fuel pump inlet port with gasket, four bolts and washers. TORQUE the bolts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
CAUTION : WHEN YOU CLOSE THE COUPLING CLAMP, MAKE SURE THAT THE SLIDE END CROSS-PIN IS INSTALLED OVER THE LIP OF THE COUPLING CLAMP-BODY. INCORRECT ASSEMBLY CAN CAUSE COUPLING CLAMP FAILURE.
(9)Make certain the fuel pump is aligned correctly as follows :
NOTE : The fuel pump discharge tube and the fuel return tube must be installed one at a time to do the inspection correctly. There is no access when both tubes are installed. The fuel pump discharge tube must be inspected before the fuel return tube.
(a)Temporarily install the fuel pump discharge tube to the MEC adapter pad with four bolts. Tighten the bolts, but do not torque.
NOTE : The gasket is not installed at this time.
(b)Use handpressure and push the tube against the fuel pump pad. Measure the clearance of the fuel tube flange at the pump end of the tube in four different quadrants. The difference between the four quadrants must be smaller than 0.004 in. (0.10 mm) for each fuel tube. (Ref. Fig. 402)
(c)If the difference is smaller than 0.004 in. (0.10 mm), remove the four bolts that attach the fuel pump discharge tube to the MEC adapter pad and repeat step 2.C.(5) for the fuel return tube.
(d)If the difference is larger than 0.004 in. (0.10 mm), align the fuel pump as follows :
1 Disconnect the fuel inlet hose from the inlet port of the fuel pump by

removal of the four bolts and washers.

2 Loosen the coupling clamp at the fuel pump to permit angular rotation in the limits of the alignment pins. Turn the fuel pump until the difference between the four quadrants is smaller than 0.004 in. (0.10 mm).

3 TORQUE the coupling clamp three times to between 115 and 125 lbf.in. (1.30 and 1.41 m.daN). Lightly hit the perimeter of the coupling with a soft-faced mallet while the coupling nut is torqued.

4 Connect the fuel inlet hose to the fuel pump inlet port with gasket, four bolts and washers. TORQUE the bolts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).

(10)Install the discharge tube.

(a)Lubricate the threads of the bolts with Lubricant (Material No.C02-058).

(b)Attach the aft end of the tube to the upper four-bolt pad on the fuel pump. Use a gasket and four bolts (Ref. Fig. 403).

(c)Install the discharge tube. Attach the forward end of the tube to the upper four-bolt pad on the adapter. Use the gasket and four bolts. If equipped with condition monitoring, install the bracket to the forward bolt holes. Keep the tab pointed out .

(d)TORQUE the four bolts at each end of the discharge tube to between 110 and 140 lbf.in. (1.24 and 1.58 m.daN).
Safety the bolts with wire (Ref. Fig. 403).

(11)Install the MEC bypass tube.

(a)Lubricate the threads of the bolts with Lubricant (Material No.C02-058).

(b)Attach the forward end of the tube to the lower four-bolt pad on the fuel pump. Use the gasket and four bolts (Ref. Fig. 403).

(c)Install the bypass tube. Attach the aft end of the tube to the lower four-bolt pad on the adapter. Use the gasket and four bolts.

(d)TORQUE the four bolts at each end of the discharge tube to between 110 and 140 lbf.in. (1.24 and 1.58 m.daN). Safety the bolts with wire.

(12)Install fuel pressure transmitter (Ref. 73-33-11, P. Block 401).

(13)Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501).

D. Removal of Strainer Assembly (Ref. Fig. 404)

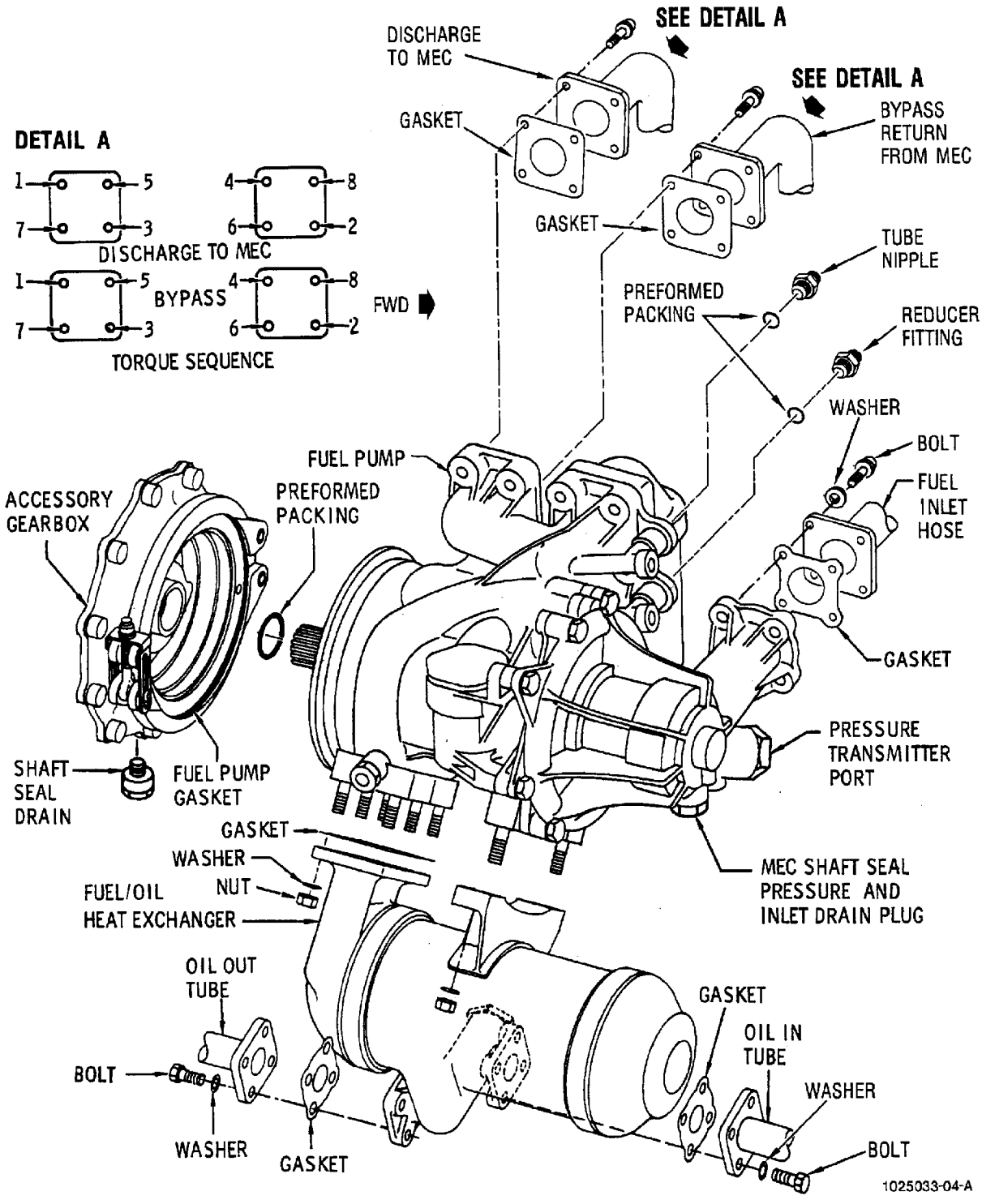
(1)Remove strainer assembly by removing 3 screws and flat-washers. Use removed screws as jackscrews in jackscrew holes to remove the strainer assembly.

**ON A/C 001-004,

(2)Remove and discard preformed packing from groove in strainer cap.
CAUTION : DO NOT DISASSEMBLE THE STRAINER, DAMAGE CAN OCCUR TO THE BOLT THAT RETAINS THE STRAINER TO THE STRAINER CAP.

**ON A/C 005-100,

(2)Remove and discard preformed packing from groove in strainer cap.



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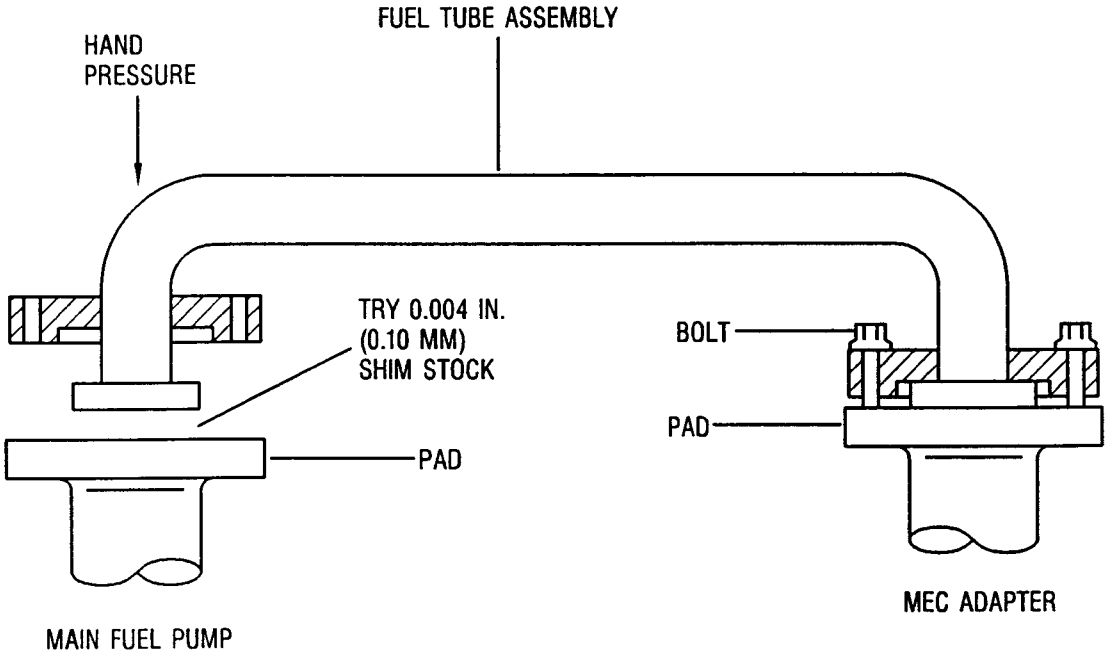
Fuel Pump Removal/Installation
Figure 401



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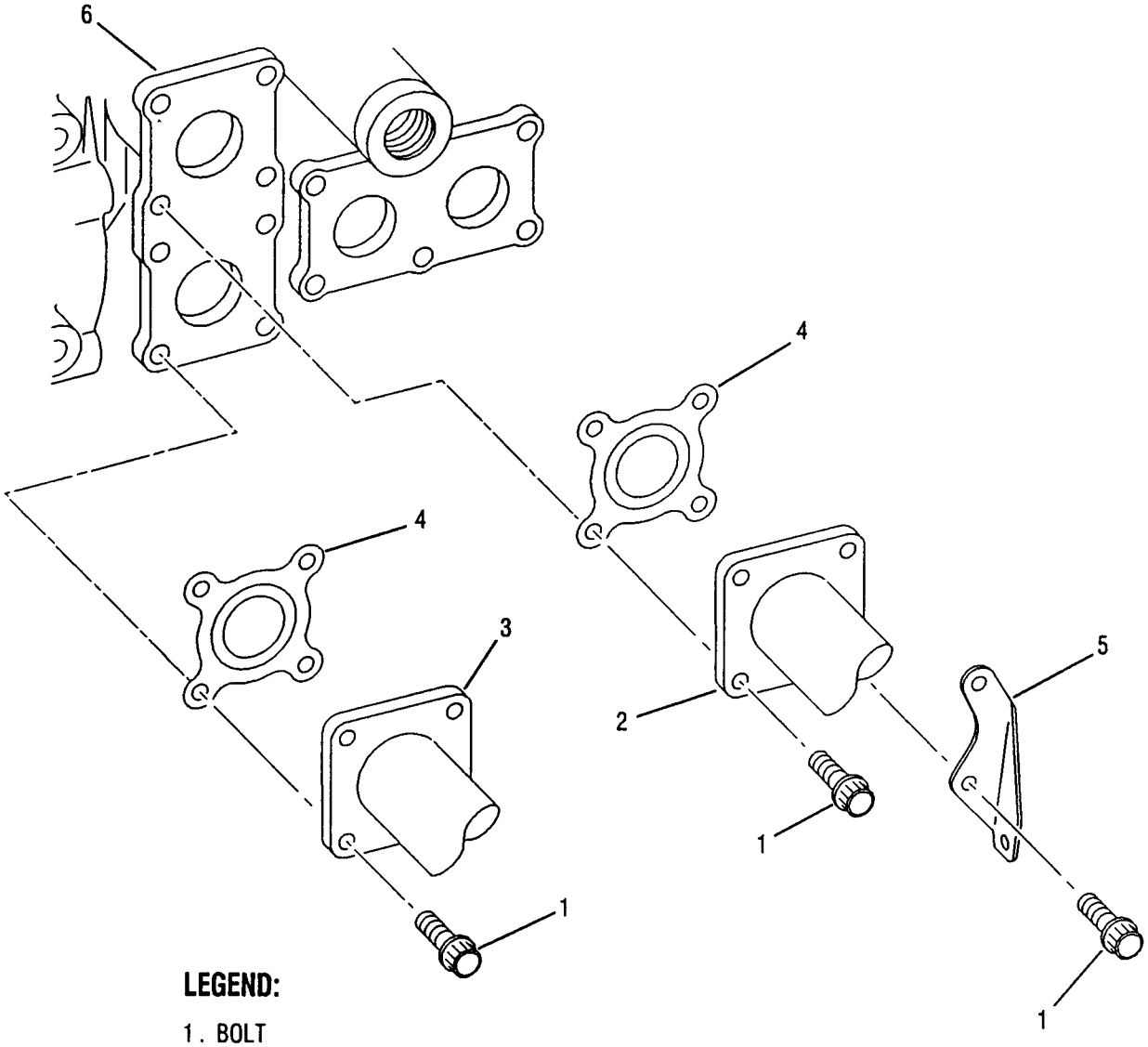
Fuel Tube Assembly Flatness Inspection
Figure 402



LEGEND:

1. BOLT
2. FUEL TUBE
3. FUEL TUBE
4. SEAL GASKET
5. CONDITION MONITORING BRACKET (IF EQUIPPED)
6. ADAPTER

1107918-00-A

BM5 73 12 01 4 LGMO - 00

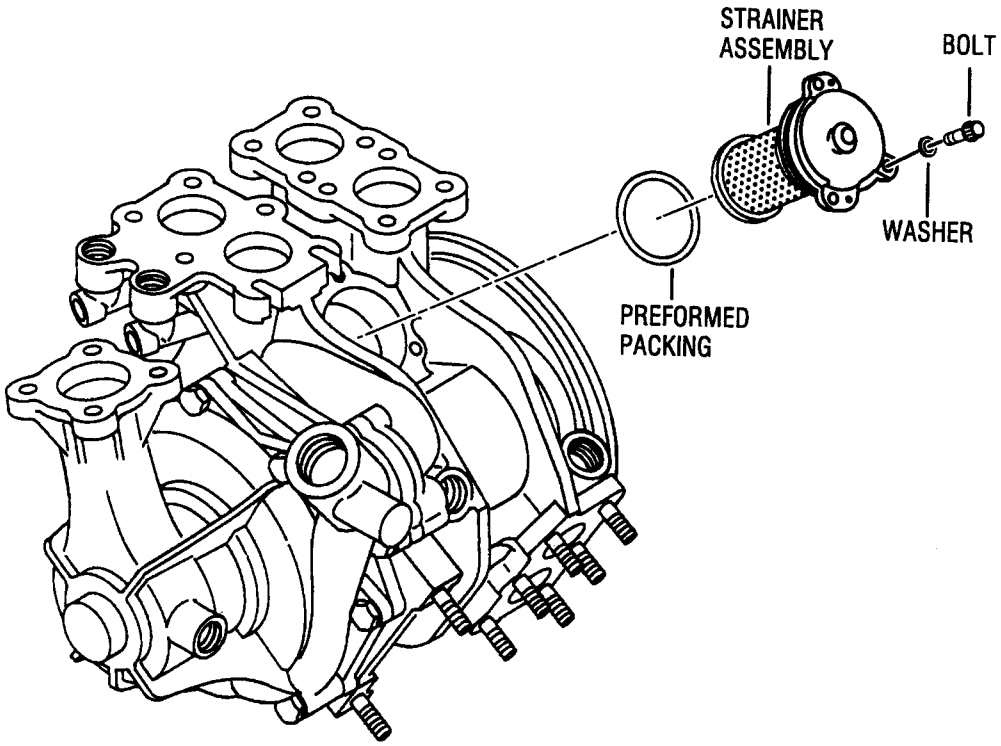
Fuel Tube Assemblies Installation
Figure 403

CAUTION : DO NOT DISASSEMBLE THE STRAINER.

R **ON A/C 001-100,

E. Installation of Strainer Assembly (Ref. Fig. 404)
(1)Lubricate a new preformed packing with oil (C02-021) and install in groove in strainer cap.
(2)Install strainer assembly into pump assembly.
(3)Install three washers and bolts. TORQUE to between 24 and 27 lbf.in. (0.27 and 0.30 m.daN.).
(4)Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501).

F. Close-Up and Test
(1)On overhead panel, push ENG 1 (2) FIRE handle (Ref. 28-24-00, P. Block 1).
(2)Remove safety clips and tags and close circuit breakers 1KG, 1JH, 2JH, 1KM, 2KM, 1WE, 3WE, 5WE and 7WE.
(3)Close thrust reverser doors.
(4)Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501).
(5)Open thrust reverser doors.
(6)Check fuel pump for fuel leakage.
(7)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(8)Close fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).



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Strainer Assembly Removal/Installation
Figure 404

FUEL PUMP - INSPECTION/CHECK

1. General

The procedure that follows is for the inspection of the fuel pump located at the 5:30 o'clock position on the accessory gearbox (aft looking forward).

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B. Material No.C04-002	Cleaning Compounds and Solvents (Ref. 70-00-00)
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 73-12-01, P. Block 401	Fuel Pump

3. Procedure

A. Job Set-Up

(1)Open, safety, and tag the appropriate circuit breakers and open the fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Fuel Pump Inspection/Check

(1)Examine the items that follow :

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(a)Installed Pump for :		
1 Sign of leakage	None permitted at pump housing porting surfaces. 3 cc/min permitted at shaft seal drain at idle. None permitted from housing casting or split line.	Replace the pump
(b)Cartridge Strainer Element for :		
1 Contamination	None permitted	Clean or replace the strainer element
2 Punctures or enlarged holes	None permitted	Replace the Strainer element

C. Cleaning of Cartridge Strainer Element

WARNING : SOLVENT, MATERIAL No.C04-002, IS TOXIC AND SHOULD BE USED WITH ADEQUATE VENTILATION. AVOID PROLONGED BREATHING OF VAPORS. REPEATED OR PROLONGED CONTACT WITH THE SKIN WILL REMOVE OILS AND CAUSE SEVERE DERMATITIS.

(1)Put the element into solvent Material No.C04-002 and clean with a stiff bristle brush. Float dislodged contaminants from strainer element.

(2)Hold screen up to light and visually inspect for contamination between

inside and outside screens, and/or cut or broken screen wire.

(3)If all contaminants cannot be removed by brushing method, replace strainer element.

Pre SB GE 73-175

D. Inspect the fuel pump locking inserts as follows :

NOTE : Main fuel pumps with the part numbers that follow are Pre SB GE 73-175 and need to have the locking inserts checked : P/N 5006834D, 5006834E, 5006834F, 5006834G, 5006834H and 5006834J.

(1)Install the eight bolts into the inserts on the two four bolt pads. These are the bolts that attach the fuel pump discharge and fuel bypass tubes.

(2)Make sure that the running torque on the eight bolts is between 3 and 30 lbf.in. (0.034 and 0.34 m.daN). If the running torque is less than 3 lbf.in (0.034 m.daN) or greater than 30 lbf.in. (0.34 m.daN), remove and replace the fuel pump (Ref. 73-12-01, P. Block 401).

(3)Remove the eight bolts used to do the inspection.

End Pre SB GE 73-175

E. Close-Up

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2)Remove safety clips and tags and close circuit breakers. Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

FILTER ELEMENT-FUEL - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A. Material No.C02-021	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
B.	Torque Wrench 100-130 lbf. in. (1.13 - 1.47 m.daN)
C.	Filter Element
D.	Gaskets
E.	Corrosion Resistant Steel Lockwire (Ref. 70-00-00)
F.	Container 1 GALLON US (4 l)
Referenced Procedures	
- 28-24-00, P. Block 1	LP Fuel Fire Shut Off Control
- 71-00-00, P. Block 501	Power Plant
- 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers

PANEL	SERVICE	IDENT.	LOCATION
133VU	ENG 1 & 2/START/CTL &/WARN	1KG	335/R68
133VU	ENG 1 & 2/IGNITION/SYS A	1JH	334/S72
133VU	ENG 1 & 2/IGNITION/SYS B	2JH	333/T72
133VU	ENG 1/REVERSE/CTL	1KM	332/U69
133VU	ENG 2/REVERSE/CTL	2KM	331/V74
133VU	ENG 1 & 2/FIRE EXTING/SQUIB A/BTL 1	1WE	335/R71
133VU	ENG 1 & 2/FIRE EXTING/SQUIB A/BTL 2	3WE	335/R72
22VU	FIRE EXTING/ENG 1 & 2/SQUIB B/BTL 1	5WE	207/C19
22VU	FIRE EXTING/ENG 1 & 2/SQUIB B/BTL 2	7WE	207/C20

(2)On overhead panel, pull ENG 1 (2) FIRE handle (Ref. 28-24-00, P. Block 1)

(3)Open fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).

B. Removal of Fuel Filter Bowl (Ref. Fig. 401)

(1)Remove filter bowl.

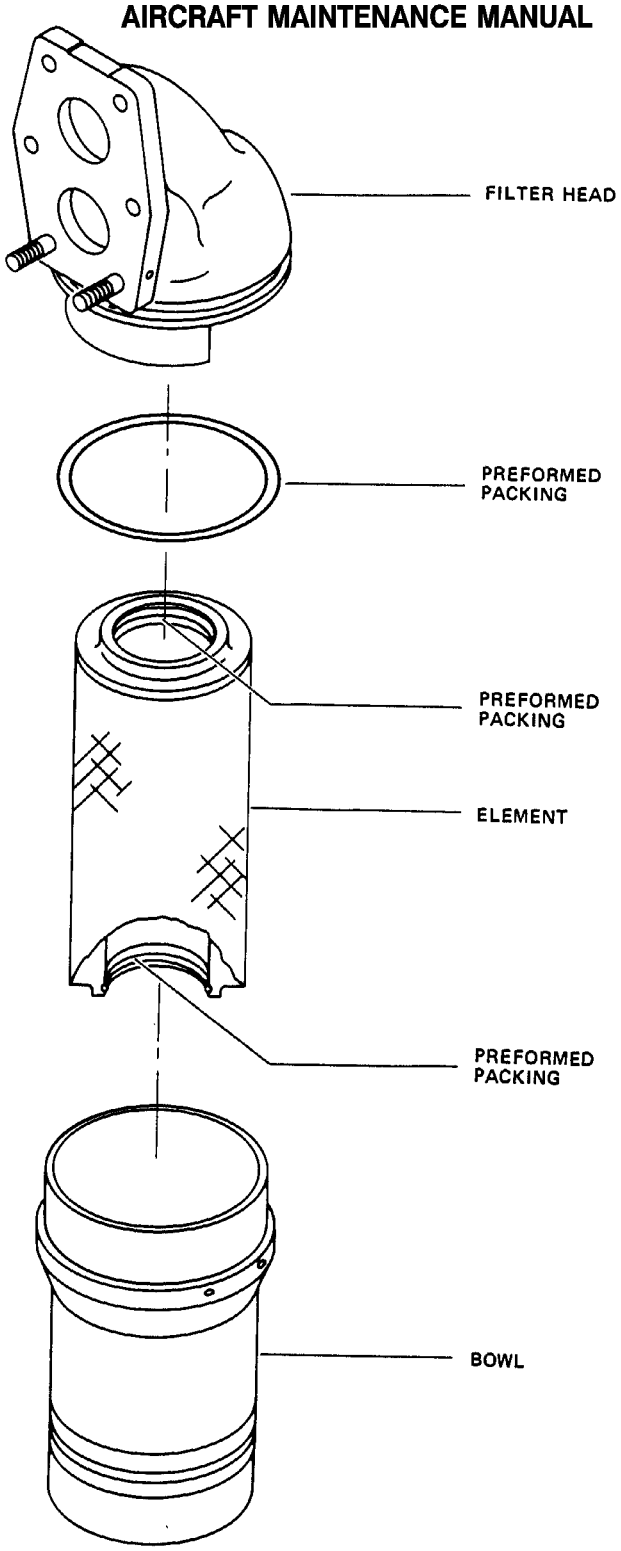
(2)Remove filter element.

C. Installation of Fuel Filter Bowl

NOTE : Lubricate all preformed packings, sealing surface and threads of bowl and head with a light coating of oil (C02-021).

(1)Carefully insert preformed packing into filter head using blunt instrument) (tongue depressor).

NOTE : To ensure proper assembly, check for free circumferential movement of preformed packing in groove.



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Filter Element - Fuel
Figure 401

(2)Carefully push and rotate either end of filter element into filter bowl until filter element bottoms.
(3)Install filter bowl and hand tighten until bowl flange bottoms against head.
NOTE : Rotate bowl during insertion to avoid damaging preformed packing in head.
(4)Wirelock filter bowl to filter head.

D. Close-Up and Test
(1)On overhead panel, push ENG 1 (2) FIRE handle (Ref. 28-24-00, P. Block 1).
(2)Remove safety clips and tags and close circuit brakers 1KG, 1JH, 2JH, 1KM, 2KM, 1WE, 3WE, 5WE and 7WE.
(3)Close thrust reverser doors.
(4)Perform test as indicated in "Type of testing after engine component
R replacement" (Ref. 71-00-00, P. Block 501) (see "Fuel Filter (73-12-03)).
(5)Open thrust reversers doors.
NOTE : When engine dry motoring is performed, ensure that outside of filter bowl is dry. Allow sufficient time to ensure that possible leak is not residual fuel weeping from filter bowl threads or from under the identification band.
(6)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(7)Close fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).

FILTER ELEMENT-FUEL - INSPECTION/CHECK

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 73-12-02, P. Block 401	Filter Element-Fuel

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the appropriate circuit breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

(2)Remove fuel filter element (Ref. 73-12-02, P. Block 401).

B. Inspection/Check

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(1)Filter Element for :		
(a)Contamination	None allowed	Discard and replace fuel filter element

C. Close-Up

(1)Install fuel filter element (Ref. 73-12-02, P. Block 401).

(2)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(3)Remove safety clips and tags and close circuit breakers. Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

FUEL FILTER - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A. Material No.C02-019	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
B. Material No.C02-021	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
C.	Torque Wrench 100-130 lbf. in. (1.13 - 1.47 m.daN)
D. 2C14854	Tool, Torque Adapter
E.	Filter Element
F.	Gaskets
G.	Corrosion Resistant Steel Lockwire (Ref. 70-00-00)
H.	Container 1 GALLON US (4 l)
Referenced Procedures	
- 28-24-00, P. Block 1	LP Fuel Fire Shut Off Control
- 70-00-00, P. Block 201	Engine - Standard Practices
- 71-00-00, P. Block 501	Power Plant
- 71-13-00, P. Block 301	Cowl Doors
- 73-12-02, P. Block 401	Filter Element - Fuel

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers

PANEL	SERVICE	IDENT.	LOCATION
133VU	ENG 1 & 2/START/CTL &/WARN	1KG	335/R68
133VU	ENG 1 & 2/IGNITION/SYS A	1JH	334/S72
133VU	ENG 1 & 2/IGNITION/SYS B	2JH	333/T72
133VU	ENG 1/REVERSE/CTL	1KM	332/U69
133VU	ENG 2/REVERSE/CTL	2KM	331/V74
133VU	ENG 1 & 2/FIRE EXTING/SQUIB A/BTL 1	1WE	335/R71
133VU	ENG 1 & 2/FIRE EXTING/SQUIB A/BTL 2	3WE	335/R72
22VU	FIRE EXTING/ENG 1 & 2/SQUIB B/BTL 1	5WE	207/C19
22VU	FIRE EXTING/ENG 1 & 2/SQUIB B/BTL 2	7WE	207/C20

(2)On overhead panel, pull ENG 1 (2) FIRE handle (Ref. 28-24-00, P. Block 1)

(3)Open fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).

B. Removal of the Fuel Filter (Ref. Fig. 401)

(1)Put a container under the fuel filter.

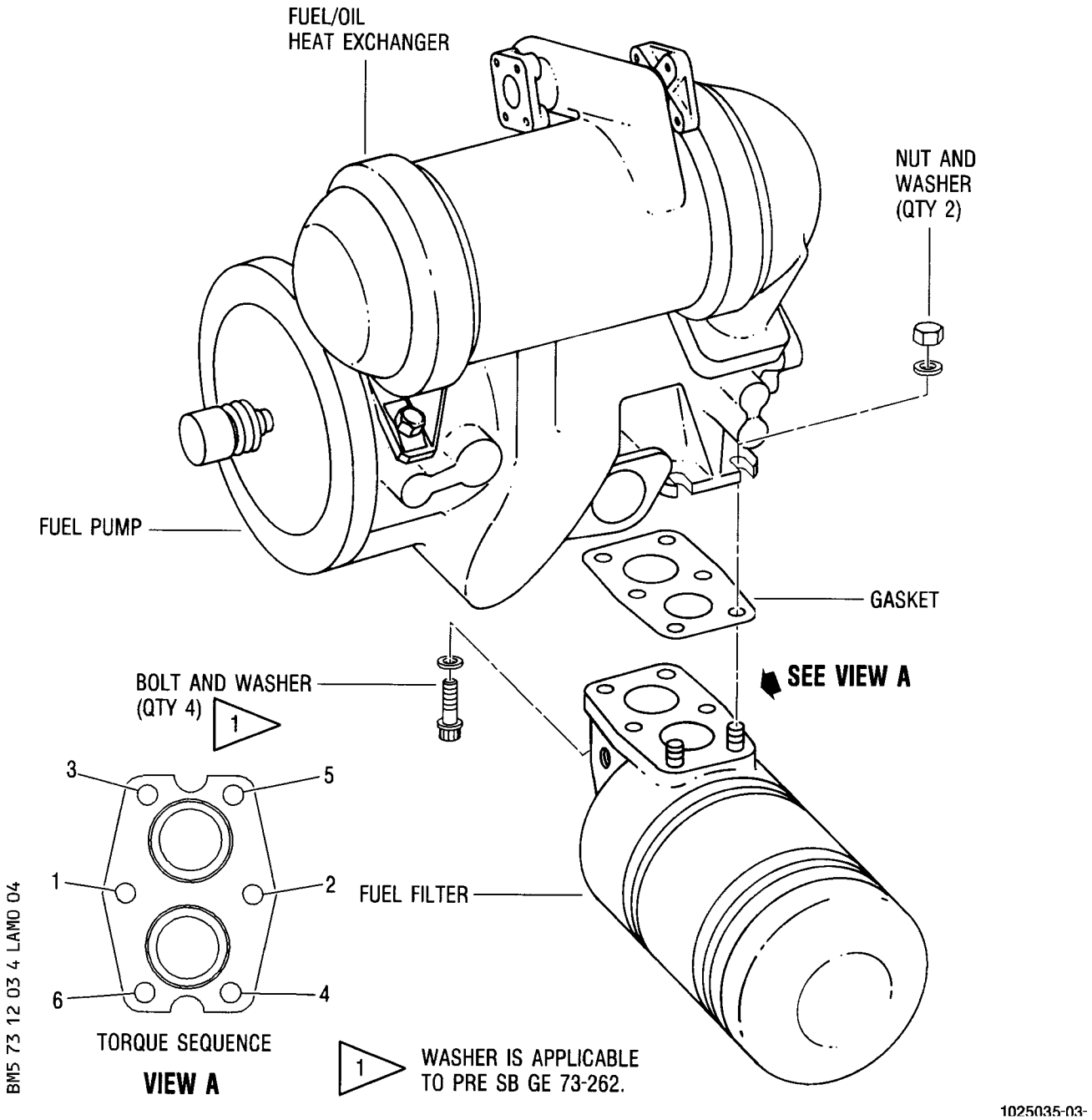
Pre SB GE 73-262

(2)Remove the four bolts and washers that attach the fuel filter to the fuel pump.

End Pre SB GE 73-262
Post SB GE 73-262
(2)Remove the four bolts that attach the fuel filter to the fuel pump.
End Post SB GE 73-262
(3)Use the tool 2C14854G02 to loosen the two nuts that attach the fuel filter to the fuel pump. Do not remove the nuts.
(4)If the tool 2C14854G02 is not available, do these steps for better access to the bottom two nuts.
(a)Remove the fuel filter bowl and fuel filter element (Ref. 73-12-02, P. Block 401).
(b)Use a torque adapter with a 3/8 in. square drive and 1/2 in. spline to loosen the bottom two nuts on the filter head.
(5)Remove the fuel filter and gasket.
NOTE : The fuel pump flange is slotted to allow the filter removal without the complete removal of the nuts.
(6)Remove the two nuts and gasket from the fuel filter.
Discard the gasket.

C. Installation of the Fuel Filter
NOTE : Fuel components that have Fluorocarbon (Viton) external seals (SB 73-079) can leak for a short period of time when they are below -29°F (-34°C). If a leak occurs, continue the start to idle.
- If the fuel leakage stops in less than 5 minutes at idle, continue operation of the engine.
- If the fuel leakage continues after 5 minutes at idle, shut down the engine and repair the source of the leakage.

(1)Lubricate the nuts and bolts with Material No.C02-019 or C02-021.
(2)Install the new gasket on the fuel filter.
(3)Install the two nuts and washers on the studs of the fuel filter.
CAUTION : MAKE SURE THE WASHERS ON THE FILTER HEAD STUDS ARE NOT BETWEEN THE FILTER AND FUEL PUMP MATING SURFACES. IF THE WASHERS ARE NOT IN THE CORRECT POSITION, FUEL WILL LEAK FROM THE MATING SURFACE.
Pre SB GE 73-262
(4)Install the fuel filter onto the fuel pump with the four bolts and washers, and the two nuts and washers.
End Pre SB GE 73-262
Post SB GE 73-262
(4)Install the fuel filter to the fuel pump with the four bolts and the two nuts and washers.
End Post SB GE 73-262
CAUTION : MAKE SURE THAT YOU USE THE TOOL 2C14854G02 TO TIGHTEN THE TWO NUTS TO THE CORRECT TORQUE VALUE. YOU CANNOT EASILY SEE THESE NUTS. IF YOU INSTALL THESE NUTS INCORRECTLY, FUEL LEAKAGE CAN OCCUR.
(5)Tighten the four bolts and two nuts finger-tight.
(a)Use the standard tightening practices (Ref. 70-00-00, P. Block 201) and follow the torque sequence shown in (Ref. Fig. 401).
(b)Use the tool 2C14854G02 to tighten the bottom two nuts.
1 If the tool is not available, remove the fuel filter bowl and element from the filter housing, if not already removed.
2 Use a torque adapter with a 3/8 in. drive end and 1/2 in. box end to



Fuel Filter Removal/Installation
Figure 401

get better access to the bottom two nuts.

(6)TORQUE the four bolts and two nuts to between 150 and 160 lbf.in. (1.69 and 1.81 m.daN).

(7)If the tool 2C14854G02 was not available, install the fuel filter element and fuel filter bowl (Ref. 73-12-02, P. Block 401).

D. Close-Up and Test

(1)On overhead panel, push ENG 1 (2) FIRE handle (Ref. 28-24-00, P. Block 301).

(2)Remove safety clips and tags and close circuit brakers 1KG, 1JH, 2JH, 1KM, 2KM, 1WE, 3WE, 5WE and 7WE.

(3)Close thrust reverser doors.

(4)Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501).

(5)Open thrust reversers doors.

NOTE : When engine dry motoring is performed, make sure that outside of filter bowl is dry. Allow sufficient time to make sure that possible leak is not residual fuel weeping from filter bowl threads or from under the identification band.

(6)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(7)Close fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).

FUEL FILTER - INSPECTION/CHECK

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 73-12-03, P. Block 401	Fuel Filter

2. Procedure

A. Job Set-Up
(1)Open, safety and tag the appropriate circuit breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).
(2)Remove fuel filter (Ref. 73-12-03, P. Block 401)

B. Inspection/Check

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(1)Filter Element for :		
(a)Preformed packings	Present at both ends of element ID	Replace preformed packings
(b)Contamination	None allowed	Replace element
(2)Filter Head/Bowl for :		
(a)Dents and scratches on sealing surface	Any amount providing they do not extend across seal surface after removal of high metal	Replace filter head/bowl
(3)Leakage	None allowed	Replace preformed packings and/or seal as required

C. Close-Up
(1)Install fuel filter (Ref. 73-12-03, P. Block 401).
(2)Make certain that working area is clean and clear of tools and miscellaneous items of equipment
(3)Remove safety clips and tags and close circuit breakers. Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

MAIN FUEL SUPPLY LINE - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
C.	Container 5 US GAL (18.9 l)
D.	Corosion Resistant Steel Lockwire (Ref. 70-00-00)
E.	Gasket
F.	Torque Wrench 20 - 85 lbf. in. (0.23 - 0.96 m.daN)
G.	Protective Covers
Referenced Procedures	
- 28-24-00, P. Block 1	LP Fuel Fire Shut-Off Control
- 71-13-00, P. Block 301	Cowl Doors
- 71-00-00, P. Block 501	Power Plant

2. Procedure

A. Job Set-Up

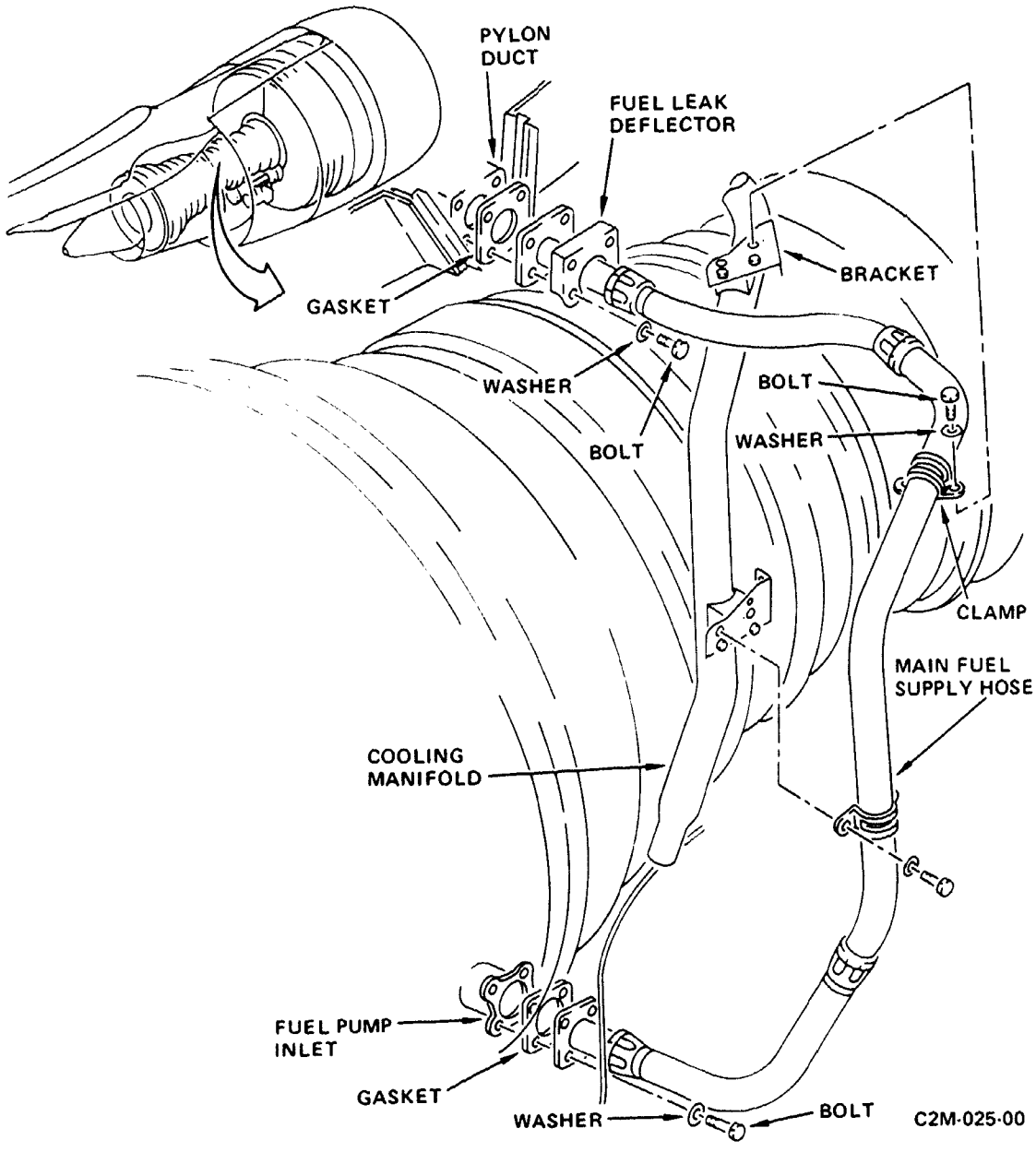
(1)Open safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
133VU	ENG 1 & 2/START/CTL &/WARN	1KG	335/R68
133VU	ENG 1 & 2/IGNITION/SYS A	1JH	334/S72
133VU	ENG 1 & 2/IGNITION/SYS B	2JH	333/T72
133VU	ENG 1/REVERSE/CTL	1KM	332/U69
133VU	ENG 2/REVERSE/CTL	2KM	331/V74
133VU	ENG 1 & 2/FIRE EXTING/SQUIB A/BTL 1	1WE	335/R71
133VU	ENG 1 & 2/FIRE EXTING/SQUIB A/BTL 2	3WE	335/R72
22VU	FIRE EXTING/ENG 1 & 2/SQUIB B/BTL 1	5WE	207/C19
22VU	FIRE EXTING/ENG 1 & 2/SQUIB B/BTL 2	7WE	207/C20

(2)On overhead panel, pull ENG 1 (2) FIRE handle (Ref. 28-24-00, P. Block 1).
(3)Open fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).
(4)Install access platform.

B. Removal (Ref. Fig. 401)

(1)Position a suitable container under fuel pump, remove drain plug and allow fuel to drain into container. Reinstall plug.
(2)Remove bolts and washers attaching gasket and line flange to fuel pump. Discard gasket. (Ref. Fig. 401)
(3)Remove bolts, washers, and clamps attaching line to brackets on cooling manifold.



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Main Fuel Supply Line - Removal/Installation
Figure 401

(4)Remove bolts and washers attaching gasket, fuel leak deflector, and line to pylon. Discard gasket and remove line from engine.
(5)Install protective covers on line, fuel pump, and pylon line attachment pads.

C. Installation
(1)Position hose on engine and attach hose, fuel leak deflector, and gasket to pylon with bolts and washers. TORQUE bolts to between 75 and 85 lbf.in. (0.85 and 0.96 m.daN) and wirelock.
(2)Attach hose to cooling manifold brackets with clamps, bolts, and washers.
R Adjust the main fuel supply hose so that it does not touch the engine
R or other parts. Make sure there is a minimum of 0.0937 in. (2.4 mm)
R clearance between the hose and the cooling manifold.
TORQUE bolts to between 20 and 25 lbf.in. (0.23 and 0.28 m.daN).
(3)Attach hose and gasket to fuel pump with bolts and washers. TORQUE bolts to between 50 and 70 lbf.in. (0.57 and 0.79 m.daN) and wirelock.

D. Test
(1)On overhead panel, push ENG 1 (2) FIRE handle (Ref. 28-24-00, P. Block 1).
(2)Remove safety clips and tags and close circuit breakers 1KG, 1JH, 2JH, 1KM, 2KM, 1WE, 3WE, 5WE and 7WE.
(3)Operate fuel pump (Ref. 28-21-00, P. Block 501).
(4)Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501) and check main fuel supply line for fuel leakage.

E. Close-Up and Test
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove access platform.
(3)Close fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).

MAIN FUEL SUPPLY LINE - INSPECTION/CHECK

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 73-12-04, P. Block 401	Main Fuel Supply Line

2. Procedure

A. Job Set-Up

(1) Open, safety and tag the appropriate circuit breakers and open right fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).

(2) Install access platform.

B. Inspection/Check

(1) Locate main fuel supply hose on right side of engine core (Ref. Fig. 601)

Rohr SB 73-192

NOTE : If Rohr SB 73-192 has been completed, the following step is not required.

End Rohr SB 73-192

Rohr SB 73-191

(2) Inspect identificaion band on hose to determine vendor cure date. If vendor cure date is more than four years, remove and replace fuel supply hose. (Ref. 73-12-04, P. Block 401).

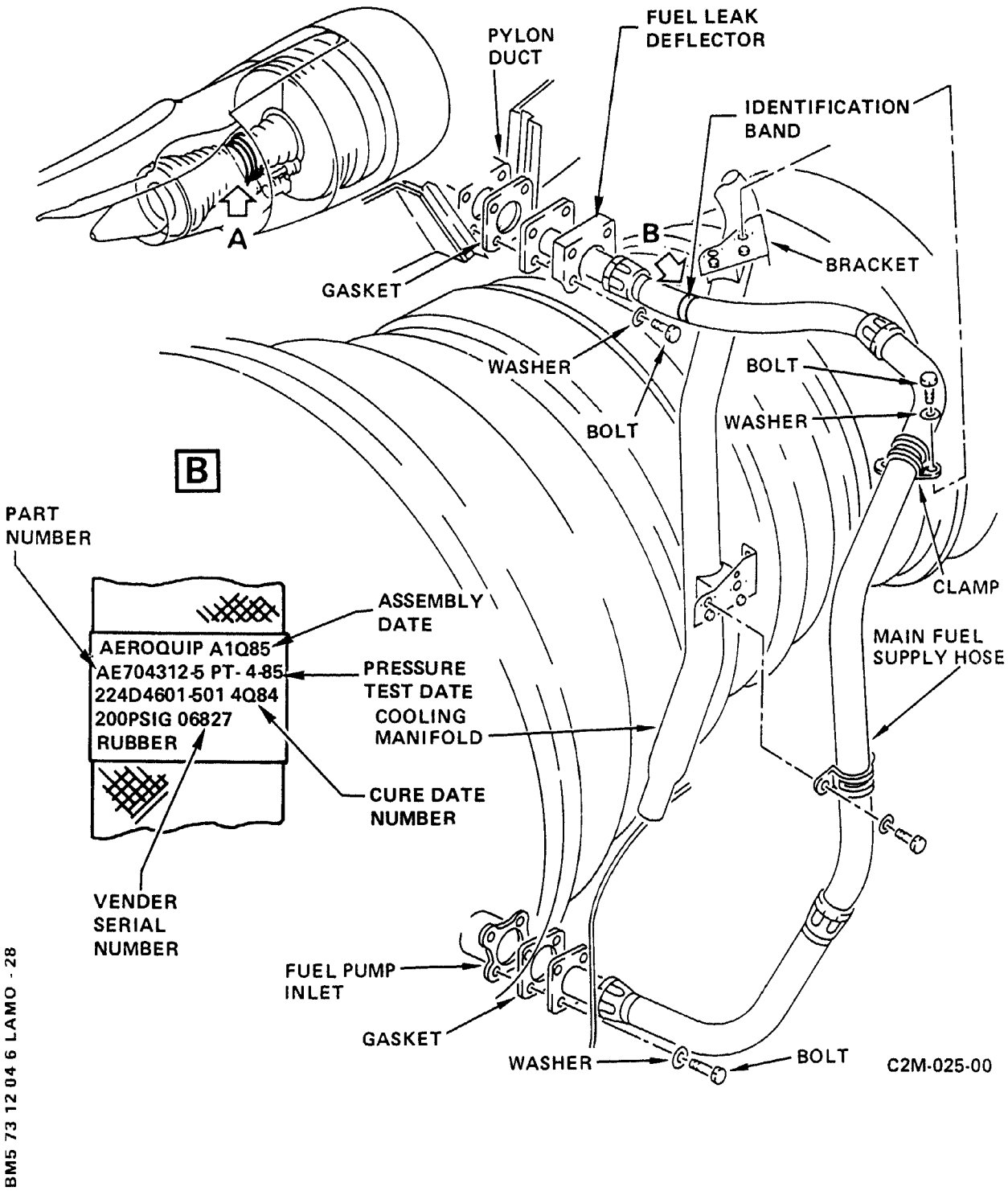
End Rohr SB 73-191

C. Close-Up

(1) Remove access platform.

(2) Remove safety clips and tags and close circuit breakers. Close fan cowls and thrust reverser doors (Ref. 71-13-00, P. Block 301).

(3) Note in engine log and/or other applicable records the information that Service Bulletin 73-035 has been incorporated.



Identification Band of Main Fuel Supply Hose
Figure 601

FUEL NOZZLES - REMOVAL/INSTALLATION

1. General

A. This maintenance procedure gives the instructions for the removal and installation of the fuel nozzles.

B. Two types of primary/secondary fuel nozzles are installed on the engine. There are 28 fuel nozzles that have a silver identification band. Two pilot nozzles, at the 6 o'clock position, have blue identification bands.

C. Access the fuel nozzles by opening the core cowls and the thrust reverser cowls.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
C. 2C14711	Closure Set, Leak Check-Fuel Manifold
D.	Container (5gal.) (19 liters)
E.	Caps and Plugs
F. Material No.C02-033	Antiseize Compounds, Lubricants, Oils (Ref. 70-00-00)
G. Material No.C05-005	Inspection and Marking Compounds (Ref. 70-00-00)
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 71-00-00, P. Block 501	Power Plant - General

3. Procedure

A. Job Set-Up
(1)Open, safety and tag the appropriate circuits breakers and open cowl doors (Ref. 71-13-00, P. Block 301).
(2)Install access platform.

B. Removal of Fuel Nozzles (Ref. Fig. 401)
Pre SB GE 73-253*** (Engines with a drain manifold)
(1)Disconnect these tubes, and drain the fuel into a container :
(a)Disconnect the tube nut that attaches the applicable fuel nozzle drain shroud to the drain manifold.
(b)Remove the safety wire from the knurled nut that holds the fuel nozzle drain shroud to the fuel nozzle.
(c)Use soft-jawed pliers to disconnect the knurled nut that attaches the fuel nozzle drain shroud to the fuel nozzle.
1 Move the fuel nozzle drain shroud in the aft direction.
(d)Disconnect the fuel nozzle supply tube from the fuel nozzle.
(e)Remove and discard the preformed packings from the fuel nozzle and

from the fuel nozzle supply tube.

(2)Remove the fuel nozzle :

NOTE : Loosen other tubes to get access to the fuel nozzle bolts, if necessary.

(a)Cut the safety wire and remove the three bolts and washers that attach the fuel nozzle to the Compressor Rear Frame (CRF).

(b)Do the steps that follow if there is a bracket attached to the fuel nozzle that you will remove :

1 Install an identification tag at the bracket location.

2 Remove the bolt that attaches the loop clamp to the bracket.

3 Remove the bracket.

(c)Carefully remove the fuel nozzle and the seal ring assembly from the CRF mounting pad.

NOTE : There are two types of fuel nozzles. Each type has a part number and a mark with color on it to show what type it is. Do not change one type of fuel nozzle for another type of nozzle.

1 Remove and discard the metal seal from the seal ring assembly.

(d)Install a cover on the fuel nozzle mounting pad for protection.

(e)Visually examine the fuel nozzle heat shield.

1 If you see signs of deterioration on the fuel nozzle heat shield, do a borescope inspection through the fuel nozzle port of the combustor outer cowl to look for signs of deterioration.

End Pre SB GE 73-253

Post SB GE 73-253*** (Engines without a drain manifold)

(1)Disconnect these tubes and drain the fuel into a container :

(a)Remove the safety wire from the knurled nut that holds the fuel nozzle drain shroud to the fuel nozzle.

(b)Use soft-jawed pliers to disconnect the knurled nut at the forward end of the fuel nozzle drain shroud.

(c)Move the fuel nozzle drain shroud aft.

(d)Remove the safety wire and disconnect the tube nut that attaches the fuel nozzle supply tube to the fuel nozzle.

(e)Remove and discard the preformed packings from the fuel nozzle and from the fuel nozzle supply tube.

(2)Remove the fuel nozzle :

NOTE : Loosen other tubes to get access to the fuel nozzle bolts, if necessary.

(a)Remove the safety wire and the three bolts that attach the fuel nozzle to the CRF mounting pad.

(b)Do the steps that follow if there is a friction dampening bracket attached to the fuel nozzle that you will remove :

1 Install an identification tag at the bracket location.

2 Remove the bolt that attaches the loop clamp to the bracket.

3 Remove the bracket.

(c)Carefully remove the fuel nozzle and the seal ring assembly from the CRF mounting pad.

NOTE : There are two types of fuel nozzles. Each type has a part number and a mark with color on it to show what type it is. Do not change one type of fuel nozzle for another type of nozzle.

1 Remove and discard the metal seal from the seal ring assembly.

(d)Install a cover on the fuel nozzle mounting pad for protection.

(e)Visually examine the fuel nozzle heat shield.
1 If you see signs of deterioration on the fuel nozzle heat shield, do a borescope inspection through the fuel nozzle port of the combustor outer cowl to look for signs of deterioration.

End Post SB GE 73-253

C. Installation of Fuel Nozzles (Ref. Fig. 401)

Pre SB GE 73-253*** (Engines with a drain manifold)

(1)Install the fuel nozzles as follows :
(a)Install a new metal seal on the seal ring assembly.
(b)Remove the cover for protection from the fuel nozzle mounting pad and make sure that the mounting pad is clean.
(c)Carefully install the seal ring assembly and the fuel nozzle on the mounting pad.

Pre SB GE 73-011*** (Fuel Nozzles - 26/4 Combination)

NOTE : There are 3 types of primary/secondary fuel nozzles used on the engine (Ref. Fig. 402). Replace the fuel nozzle with the same type of fuel nozzle that you removed. Each type has a part number and a mark with color on it to show what type it is.

End Pre SB GE 73-011

Post SB GE 73-011*** (Fuel Nozzles - 28/2 Combination)

NOTE : There are two types of fuel nozzles used on the engine (Ref. Fig. 405). Replace the fuel nozzle with the same type of fuel nozzle that you removed. Each type has a part number and a mark with color on it to show what type it is.

End Post SB GE 73-011

(d)Do the steps that follow if a bracket will be attached to the fuel nozzle that you will install :
1 Align the bracket with the bolt holes in the mounting pad.
2 Install the bolt to attach the loop clamp to the bracket.
- TORQUE to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(e)Install the three bolts to attach the fuel nozzle to the CRF mounting pad. Tighten the bolts with your hand at this time.
(f)Apply a thin layer of lubricant Material No.C02-033 to two new preformed packings.
(g)Install one new preformed packing in the groove of the fuel nozzle.
(h)Install one new preformed packing in the groove of the fuel nozzle supply tube.
(i)Connect the fuel nozzle supply tube to the fuel nozzle. Tighten with your hand at this time.
(j)Tighten the three fuel nozzle bolts to the CRF as follows :
1 TORQUE the bolts to 50 lbf.in. (0.56 m.daN) and then to between 110 and 120 lbf.in. (1.24 and 1.35 m.daN).
2 After five minutes, TORQUE the bolts again to between 110 and 120 lbf.in. (1.24 and 1.35 m.daN).
3 After five minutes more, TORQUE the bolts to between 110 and 120 lbf.in. (1.24 and 1.35 m.daN) one more time.
4 Safety the bolts in groups of three with wire.
(k)TORQUE the tube nut that connects the fuel nozzle supply tube to the fuel nozzle to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).
(l)If you disconnected all the fuel nozzles, do these steps to tighten

the tube nuts on the right fuel manifold :
1 Tighten fuel nozzle No. 6 first.
2 Then tighten the fuel nozzles in this sequence :
5, 7, 4, 8, 3, 9, 2, 10, 1, 11, 30, 12, 29 and 13.

(m)If you disconnected all the fuel nozzles, do these steps to tighten the tube nuts on the left fuel manifold :
1 Tighten fuel nozzle No. 21 first.
2 Then tighten the fuel nozzles in this sequence :
22, 20, 23, 19, 24, 18, 25, 17, 26, 16, 27, 15, 28 and 14.

(n)After five minutes, do a check of the torque value on the tube nuts.

(o)If necessary, go back to step 3.C.(1)(k) to TORQUE the tube nut(s) again.
NOTE : You must continue to do this until the tube nuts stay at the correct torque value.

(p)Do a leak test of the fuel manifold and the fuel nozzles. Refer to paragraph 3.C.(2).

(q)Move the fuel nozzle drain shroud forward.

(r)TORQUE the tube nut that attaches the fuel nozzle drain shroud to the drain manifold to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN).

(s)If you disconnected all the fuel nozzles, do these steps to tighten the tube nuts that attach the fuel nozzle drain shrouds to the fuel manifold :
1 Connect the tube nut at fuel nozzle No. 29 and then No. 15. Tighten with your hand at this time.
2 Move the remaining shrouds forward and connect the tube nuts. Tighten with your hand at this time.
3 Connect the knurled nuts of the shrouds to each fuel nozzle. Tighten with your hand at this time.
4 TORQUE the tube nuts that attach the fuel nozzle drain shroud to the drain manifold to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN).

(t)Do a leak test of the drain shroud and drain manifold. Refer to paragraph 3.C.(3).

(u)Tighten the knurled nuts with soft-jawed pliers.

(v)Safety the knurled nut to the fuel nozzle with wire.

End Pre SB GE 73-253

Post SB GE 73-253*** (Engines without a drain manifold)

(1)Install the fuel nozzles as follows:

(a)Install a new metal seal on the seal ring assembly.

(b)Remove the cover for protection from the fuel nozzle mounting pad and make sure that the mounting pad is clean.

(c)Carefully install the seal ring assembly and the fuel nozzle on the mounting pad on the CRF.

Pre SB GE 73-011*** (Fuel Nozzles - 26/4 Combination)
NOTE : There are 3 types of primary/secondary fuel nozzles used on the engine (Ref. Fig. 402). Replace the fuel nozzle with the same type of fuel nozzle that you removed. Each type has a part number and a mark with color on it to show what type it is.

End Pre SB GE 73-011

Post SB GE 73-011*** (Fuel Nozzles - 28/2 Combination)
NOTE : There are two types of fuel nozzles used on the engine (Ref. Fig. 405). Replace the fuel nozzle with the same type

of fuel nozzle that you removed. Each type has a part number and a mark with color on it to show what type it is.

End Post SB GE 73-011

(d) Do the steps that follow if a friction dampening bracket will be attached to the fuel nozzle that you will install :
1 Align the bracket with the bolt holes in the mounting pad.
2 Attach the loop clamp to the friction dampening bracket with the bolt.
3 TORQUE to between 50 and 56 lbf.in. (0.56 and 0.63 m.daN).
4 Install three bolts to attach the bracket and the nozzle to the CRF. Tighten with your hand at this time.

(e) Apply a thin layer of lubricant Material No.C02-033 to two new preformed packings.

(f) Install one new preformed packing in the groove of the fuel nozzle.

(g) Install one new preformed packing in the groove of the fuel nozzle supply tube.

(h) Connect the fuel nozzle supply tube to the fuel nozzle ; only tighten with your hand at this time.

(i) Do the steps that follow to tighten the three fuel nozzle bolts to the CRF :
1 TORQUE the bolts to between 110 and 120 lbf.in. (1.24 and 1.35 m.daN).
2 After five minutes, TORQUE the bolts again to between 110 and 120 lbf.in. (1.24 and 1.35 m.daN).
3 After five minutes more, TORQUE the bolts to between 110 and 120 lbf.in. (1.24 and 1.35 m.daN) one more time.
4 Safety the bolts in groups of three with wire.

(j) TORQUE the tube nut on the fuel nozzle supply tube to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).

(k) If you disconnected all the fuel nozzles, do these steps to tighten the tube nuts on the right fuel manifold :
1 Tighten fuel nozzle No. 6 first.
2 Then tighten the fuel nozzles in this sequence :
5, 7, 4, 8, 3, 9, 2, 10, 1, 11, 30, 12, 29 and 13.

(l) If you disconnected all the fuel nozzles, do the steps that follow to tighten the tube nuts on the left fuel manifold :
1 Tighten fuel nozzle No. 21 first.
2 Then tighten the fuel nozzles in this sequence :
22, 20, 23, 19, 24, 18, 25, 17, 26, 16, 27, 15, 28 and 14.

(m) Loosen and then TORQUE the tube nut again to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).

(n) Loosen and then TORQUE the tube nut one more time to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).

(o) Do a leak test of the fuel manifold and the fuel nozzles. Refer to paragraph 3.C.(2).

(p) Safety the tube nut on the fuel nozzle supply tube to the fuel nozzle with wire.
NOTE : Safety cable cannot be used on the tube nuts that safety the fuel nozzle supply tubes to the fuel nozzles because of the minimum clearance between the tube nuts and the fuel nozzle drain shrouds.

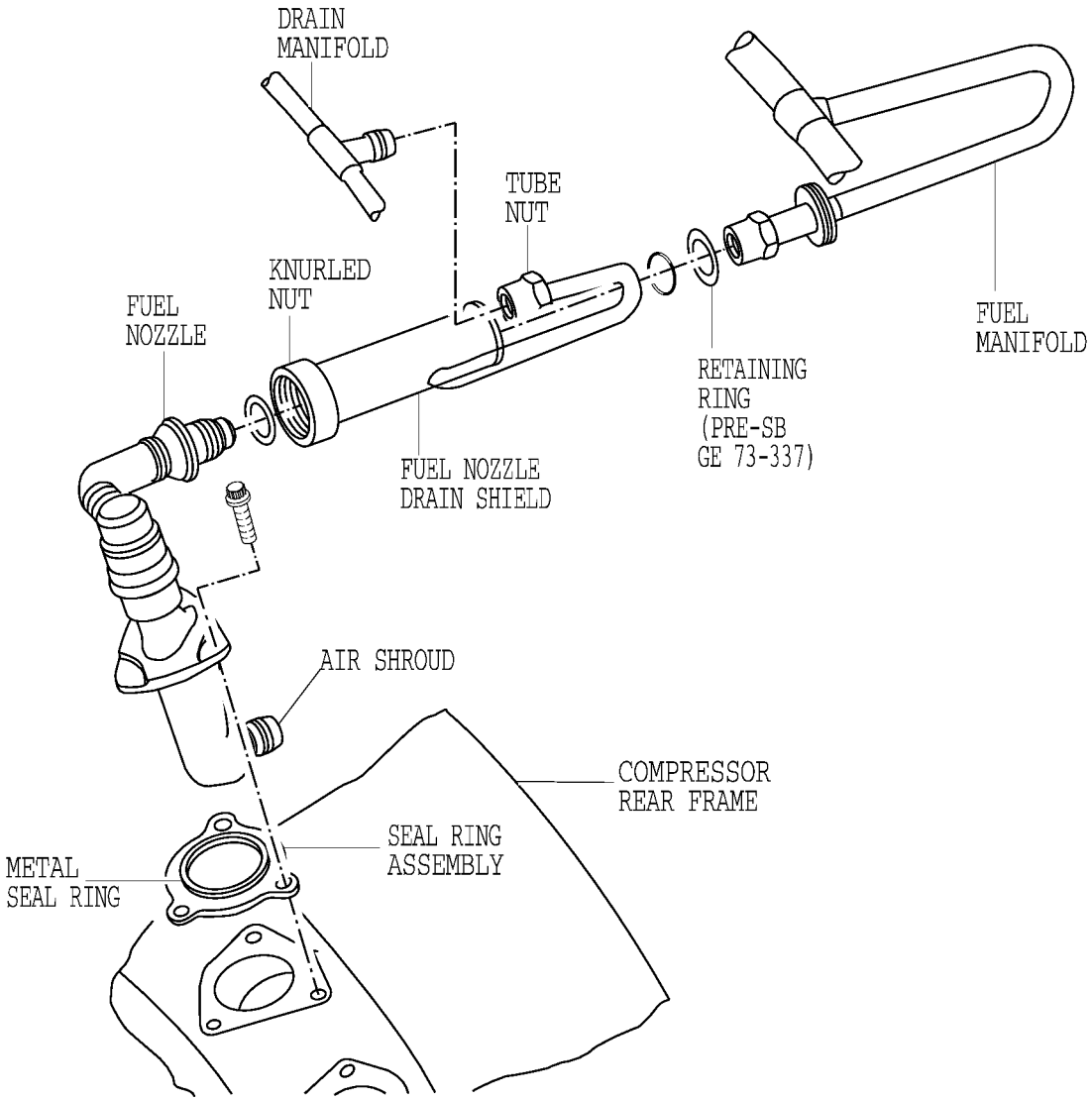
(q)Move the fuel nozzle drain shroud forward against the fuel nozzle.
(r)Tighten the knurled nut with soft-jawed pliers.
(s)Safety the knurled nut to the fuel nozzle with wire.

End Post SB GE 73-253

(2)Do a leak check of the fuel manifolds and fuel nozzles (one side at a time) as follows (Ref. Fig. 403).
(a)With access to the fuel lines (right side of the engine), disconnect the left fuel nozzle supply tube aft of the IDG fuel/oil heat exchanger.
(b)Connect a source of dry nitrogen or dry filtered shop air to the left manifold fuel inlet tube at the outboard fitting.
(c)Pressurize the left fuel tube and manifold to 200 psig (13.79 bars).
(d)Apply Material No.C05-005 or its equivalent to these locations :
1 at each tube nut on the fuel nozzle
2 at the connection at the left fuel manifold half located at the 11:00 position (5:00 position for the right side).
(e)Make certain there are no leaks.
(f)If leakage occurs, loosen the coupling nut and examine the condition of the fitting seat. If the seat is damaged, replace the fuel nozzle or fuel manifold as necessary. If the seat is not damaged, torque the nut again, and do the leak check again. No leakage is permitted.
(g)Decrease the pressure to zero psig and remove the source of the pressure.
(h)Remove the pressurized gas source from the supply tube.
(i)Do steps C.(2)(a) through C.(2)(h) for the right side fuel tube and manifold.
(j)Connect the fuel nozzle supply tubes to the fuel manifolds and the IDG fuel tube. TORQUE the B-nuts to between 650 and 770 lbf.in. (7.34 and 8.70 m.daN).

(3)Perform leak test of drain manifold and drain shrouds as follows (Ref. Fig. 404).
(a)Disconnect B-nut on drain line and connect closure set, 2C14711, to drain manifold at fitting located at the 5:30 o'clock position (forward looking aft).
(b)Connect a source of dry nitrogen or dry filtered shop air to the closure set connector and pressurize to 50-55 psig (3.4-3.8 bars).
(c)Shut off nitrogen supply when pressure is obtained.
(d)Monitor pressure for 2 minutes ; maximum of 10 psig (0.69 bars) decrease is permitted.
(e)If limits are exceeded check for leakage around knurled nuts on drain shroud, B-nuts on drain manifold and left and right connecting points of the drain manifold (located at the 6.30 o'clock and 12:30 o'clock positions forward looking aft). Use leak Tec (C05-005) to check for leaks. If leakage occurs at drain shroud knurled nut, replace preformed packing on nut and do another check. If leakage occurs on B-nut or left or right drain manifold connection replace manifold as required.
(f)Reduce pressure to zero and remove closure set.
(g)Connect drain line to drain manifold fitting and TORQUE B-nut to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN).

D. Close-Up and Test



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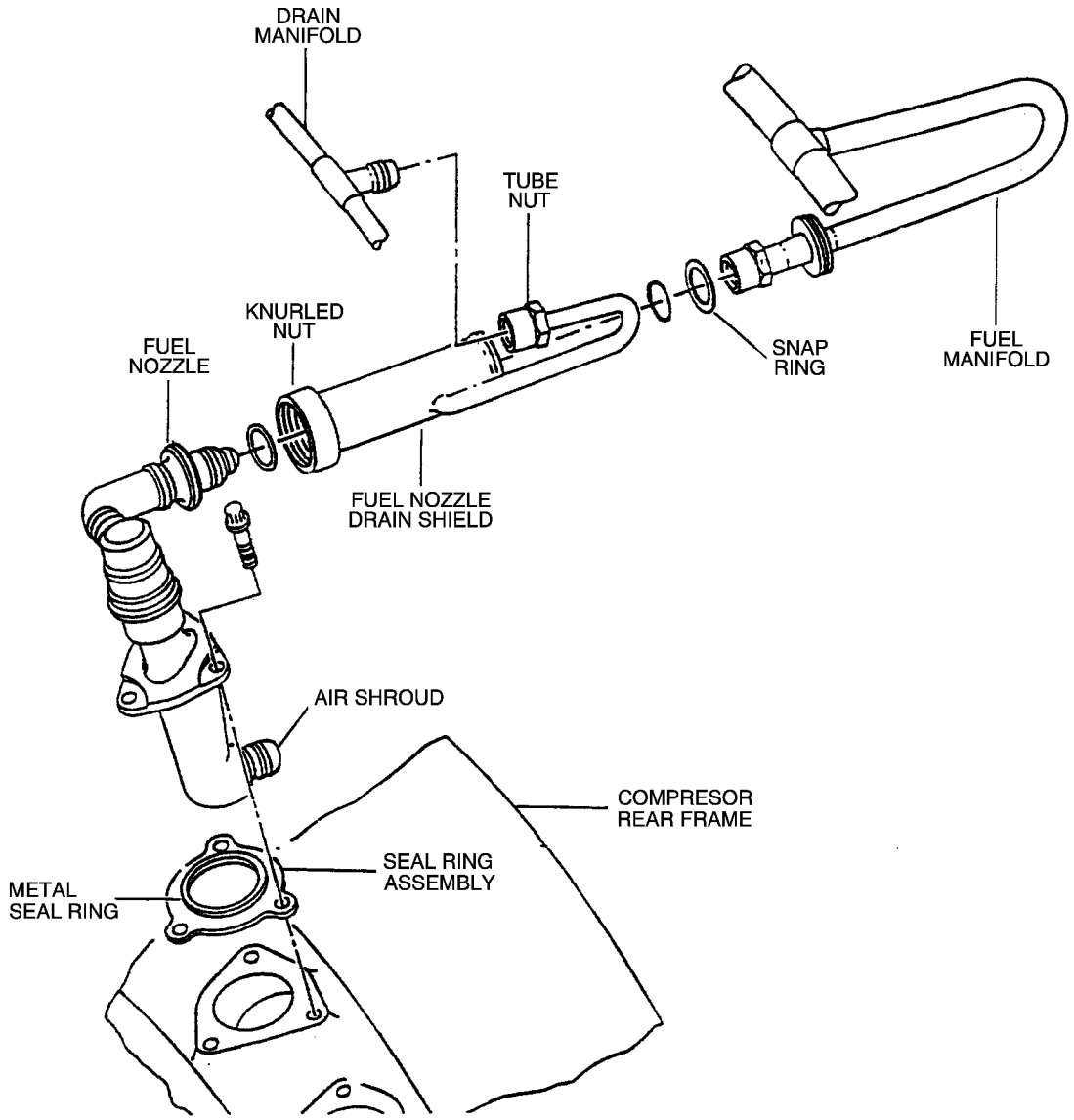
Fuel Nozzle - Removal/Installation (Pre SB GE 73-253 and Pre SB GE 73-337)(Sheet 1/3)
Figure 401

R



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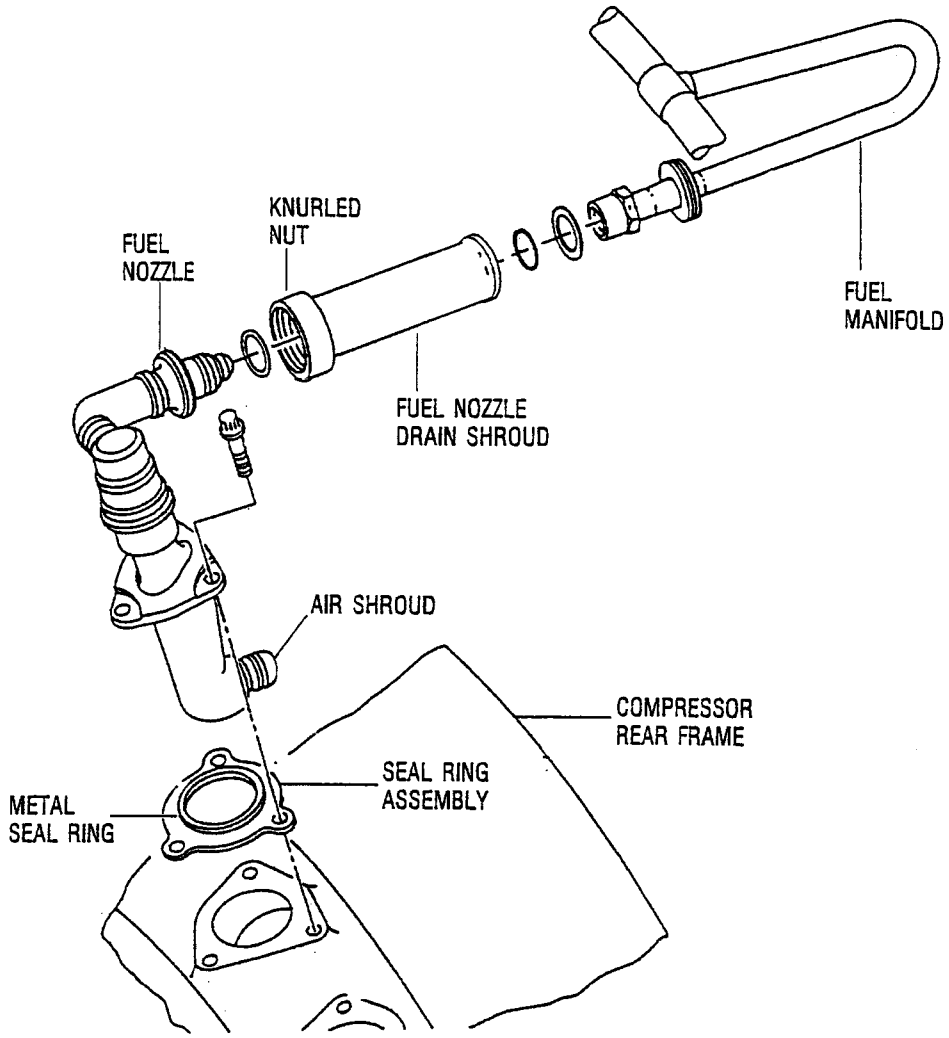
Fuel Nozzle - Removal/Installation (Pre SB GE 73-253 and Post SB GE 73-337)(Sheet 2/3)
Figure 401

R



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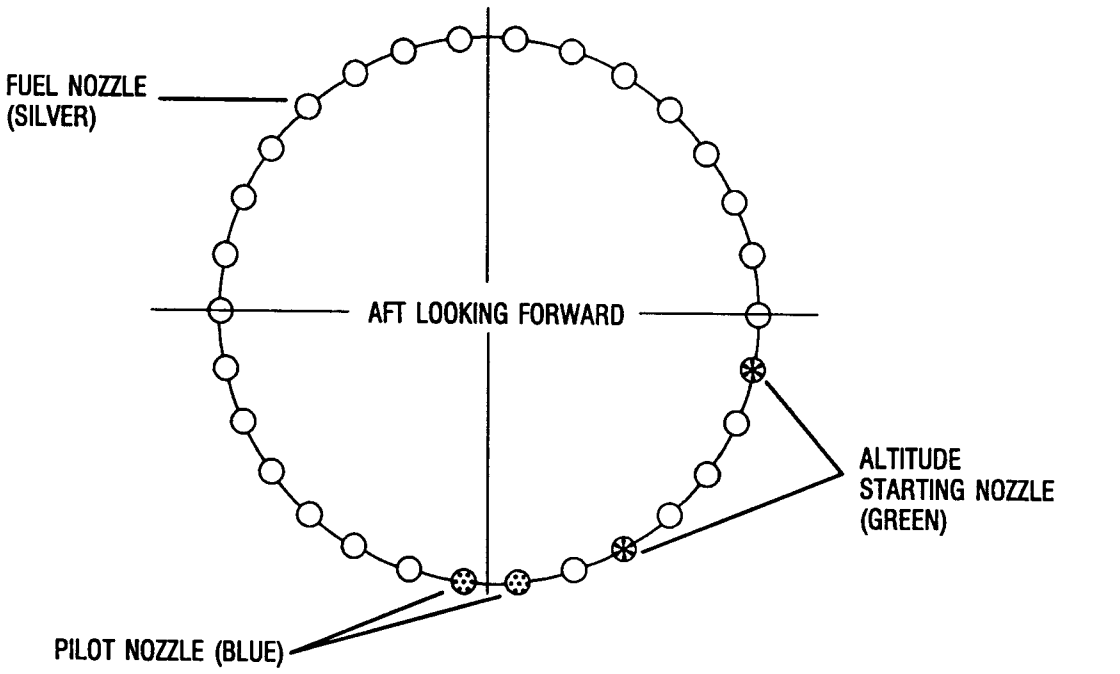
Fuel Nozzle - Removal/Installation (Post SB GE 73-253)
(Sheet 3/3)
Figure 401

R



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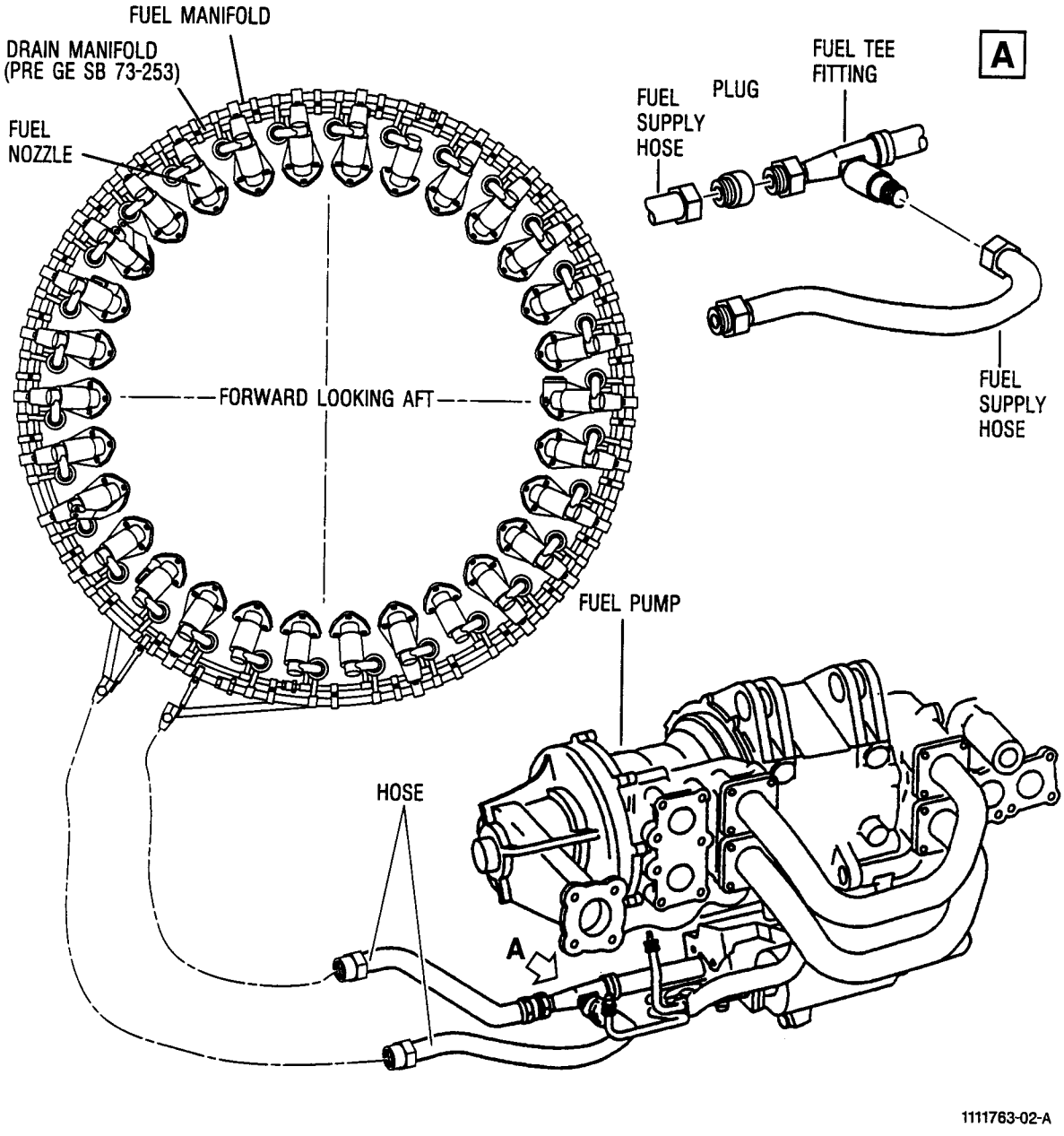
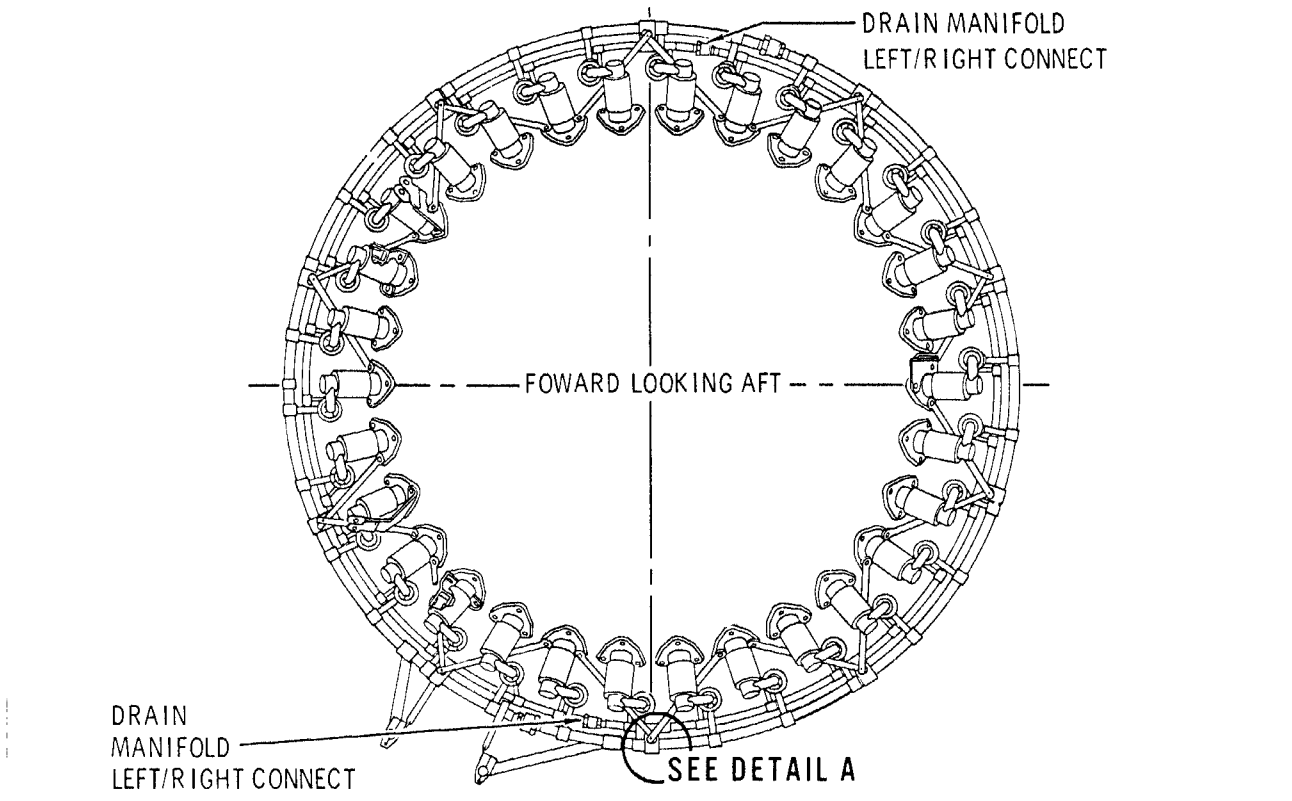
Nozzle Location (Pre GE SB 73-011)
Figure 402

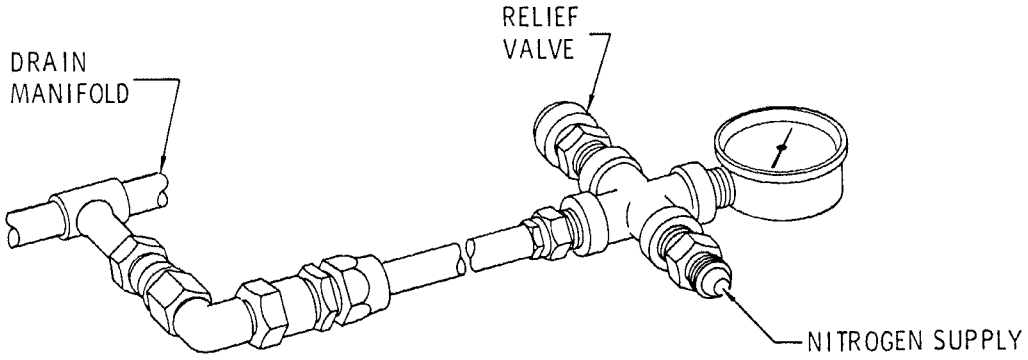


BM5 73 13 01 4 LEMO 02

Leak Check (Fuel Manifold)
Figure 403



DETAIL A



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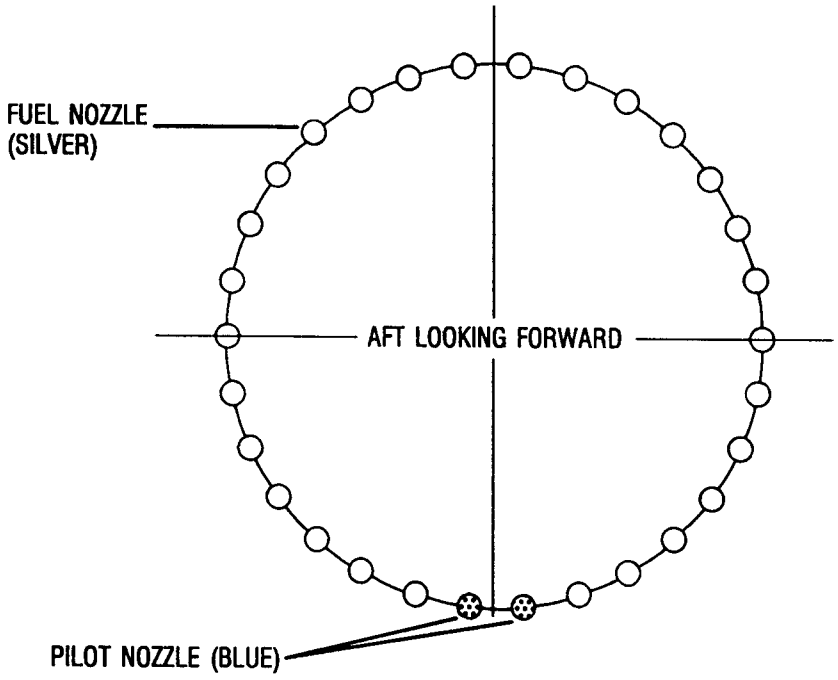
Closure Set Installation (Drain Manifold) (Pre SB GE 73-253)
Figure 404



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Nozzle Location (GE SB 73-011)
Figure 405

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove access platform.
(3)Remove safety clips and tags and close circuit breakers. Close core, thrust reverser and fan cowl doors (Ref. 71-13-00, P. BLock 301).
(4)Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501).

FUEL NOZZLES - INSPECTION/CHECK

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 73-13-01, P. Block 701	Fuel Nozzles

2. Procedure (Ref. Fig. 601)

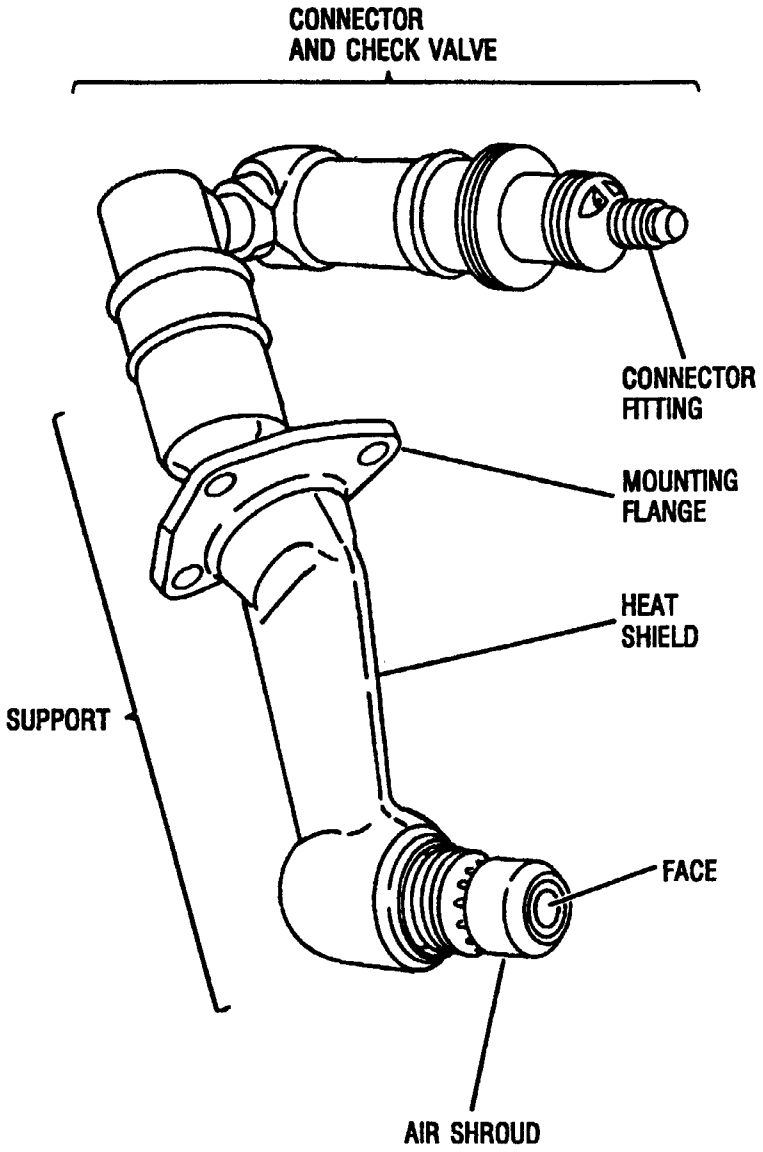
A. Job Set-Up
(1)Open, safety and tag the appropriate circuit breakers and open thrust reverser and core cowl doors (Ref. 71-13-00, P. Block 301).
(2)Install access platform.
(3)Clean fuel nozzle (Ref. 73-13-01, P. Block 701).

B. Visual Inspection/Check
Visually inspect fuel nozzles after cleaning as follows :

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(1)Connector and Fitting for :		
(a)Sealing surfaces for nicks, dents, and cracks	Not serviceable	Replace nozzle
(b)Body for nicks, and scores	Any length, not more than 0.030 in. (0.76 mm) deep after removal of high metal	Replace nozzle
(c)Cracks	Not serviceable	Replace nozzle
(2)Mounting Flange for :		
(a)Sealing surface for raised metal	Not serviceable	Remove high metal
(b)Bolt hole deformation/wear	0.293 in. (7.44 mm) maximum diameter of the two aft holes. 0.260 in. (6.60 mm) maximum diameter of one fwd hole	Replace nozzle
(3)Air Shroud for :		
(a)Dents/scores	Any number not more than 0.015 in. (0.38 mm) deep	Replace nozzle
(b)Wear	Not more than 0.015 in. (0.38 mm) deep	Replace nozzle
(c)Cracks	Not serviceable	Replace nozzle

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(4)Face for :		
(a)Carbon build-up	0.020 in. (0.51 mm) maximum	Clean
(b)Discoloration	Any amount	
(c)Nicks and scores	Not more than 0.003 in. (0.08 mm) deep	Replace nozzle
(d)Cracks	Not serviceable	Replace nozzle
(5)Heat Shield for :		
(a)Looseness	Not serviceable	Replace nozzle
(b)Nicks and scratches	Not more than 0.010 in. (0.25 mm) deep	Replace nozzle
(c)Cracks	Not serviceable	Replace nozzle
(d)Dents	Not more than 0.06 in. (1.5 mm) deep	Replace nozzle

C. Close-Up
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove access platform.
(3)Remove safety clips and tags and close circuit breakers. Close core cowl and thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).



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BM5 73 13 01 6 LAMO - 01

Fuel Nozzle Inspection
Figure 601

FUEL NOZZLES - CLEANING/PAINTING

1. Reason for the Job
This procedure pertains to the cleaning of the fuel nozzles.

2. Equipment and Materials

ITEM	DESIGNATION
A. Material No.C04-009	Cleaning Compounds and Solvents (Ref. 70-00-00)
B.	Circuit Breaker Safety Clips
C.	Access Platform
D.	Filtered Air Source
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 73-13-01, P. Block 401	Fuel Nozzles

3. Procedure

A. Job Set-Up
(1)Open, safety and tag the appropriate circuit breakers and open thrust reverser and core cowl doors (Ref. 71-13-00, P. Block 301).
(2)Remove fuel nozzles (Ref. 73-13-01, P. Block 401).

B. Cleaning
WARNING : CLEANING SOLUTION IS EXTREMELY CAUSTIC. WEAR PROTECTIVE CLOTHING, GLOVES AND FACE SHIELD TO PREVENT CONTACT WITH SKIN OR EYES. IF SOLUTION CONTACTS SKIN OR EYES, IRRIGATE THOROUGHLY WITH CLEAR WATER AND OBTAIN MEDICAL AID AT ONCE.
(1)Make cleaning solution by mixing rust remover Material No. C04-009 in proportion of 2 lbs per gallon (0.24 kg per litre) of water heated to 185°F (85°C).
(2)Connect 5 to 10 psi (0.35 - 0.70 Bar) filtered air source to nozzle inlet while brushing to prevent internal nozzle contamination.
CAUTION : MAINTAIN NOZZLE ATTITUDE DURING CLEANING TO PREVENT FLUID FROM ENTERING BEYOND TIP. WHEN SOAKING, DO NOT IMMERSE TIP MORE THAN 1/2 LENGTH OF SHROUD.
(3)Clean nozzle tip and shroud with cleaning solution by alternately soaking and brushing with a stiff bristled brush.
(4)After cleaning, rinse nozzle tip in flowing water at 180-200°F (82-93°C) until rinse water is clear.

C. Close-Up
(1)Install fuel nozzles (Ref. 73-13-01, P. Block 401).
(2)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(3)Remove access platform.
(4)Remove safety clips and tags and close circuit breakers, close core cowl and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

FUEL SUPPLY MANIFOLDS - REMOVAL/INSTALLATION

1. General

A. This procedure is written for the replacement of both fuel manifold halves. It is not necessary to replace both halves as a mating pair. If only one half is unserviceable, you can replace the damaged half while you keep the serviceable half installed. Access to the fuel manifold is through the thrust reverser doors. This procedure includes :
- removal of fuel manifolds
- installation of fuel manifolds
- fuel nozzle leak check

Pre SB GE 73-253*** (Engines with a drain manifold)
- drain shroud and drain manifold leak check.

NOTE : For Engines with GE SB 73-253 incorporated, there is no drain manifold, so this procedure would not apply.

End Pre SB GE 73-253

B. If any clamping devices show signs of distress (wear, looseness, etc.), replace the clamping device and inspect the manifold for resultant damage.

2. Equipment and Materials

	ITEM	DESIGNATION
	A.	Packing, Preformed (J221P017)
R	B.	Loop Clamps
R	C. Material No.C02-033	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
R	D. Material No.C02-019	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
R	E. Material No.C10-230	Miscellaneous (Ref. 70-00-00)
	Referenced Procedures	
	- 70-00-00, P. Block 201	Standard Practices - Engine - General
	- 71-00-00, P. Block 501	Power Plant - General
	- 71-13-00, P. Block 301	Cowl Doors
	- 73-13-01, P. Block 401	Nozzle - Fuel
	- 74-21-01, P. Block 401	Ignition Leads

3. Procedure

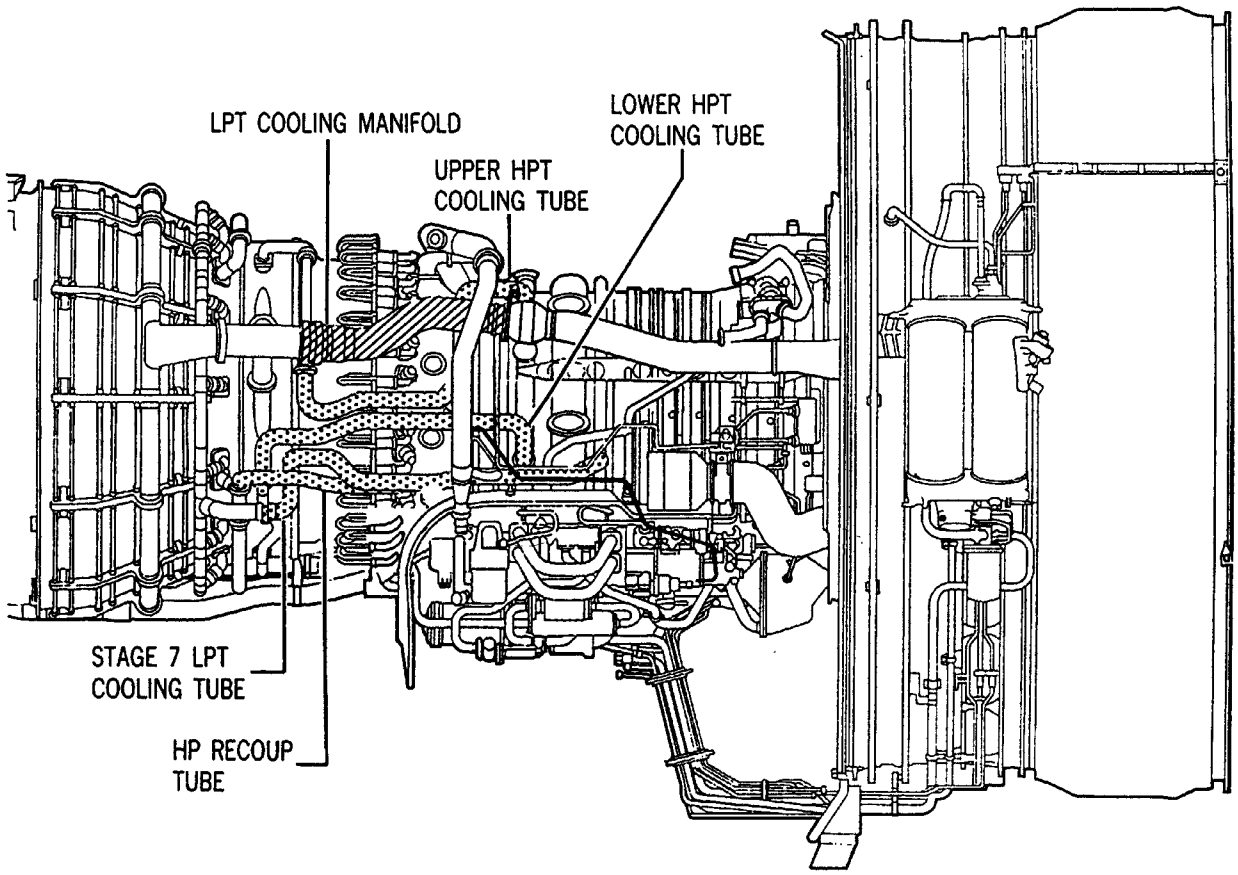
A. Job Set-Up
(1)Open the fan cowl doors, fan reverser cowl doors, and core cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal
(1)Remove any QEC equipment required to facilitate the removal of the fuel supply manifold.
(2)Removal of right side cooling air manifolds (Ref. Fig. 401).
(a)Remove the LPT cooling air manifold as follows :
1 Remove 2 nuts, 2 bolts, and strap securing the LPT manifold to the

bracket on the HPC/CRF flange.
2 Disconnect the LPT from the control valve and HPT/LPT inlet manifold by loosening and disconnecting the coupling clamps. Retain seals for reinstallation.
3 Remove the LPT manifold section.
(b)Remove the upper HPT cooling tube as follows :
1 Remove the nut, bolt, and double strap securing and separating the upper and lower HPT cooling tubes.
2 Remove 2 nuts, 2 bolts, 2 washers, and strap securing the upper cooling tube to the bracket on the CRF/HPT flange.
3 Remove 2 nuts, 2 bolts, 2 washers, and strap securing the upper cooling tube to the bracket on the HPC/CRF flange.
4 Disconnect the coupling clamp and misalignment fitting at compressor case and HPT case tubes. Remove the tube. Retain the seal.
(c)Remove the lower HPT cooling tube as follows :
1 Remove 2 nuts, 2 bolts, and strap securing the lower tube to bracket on HPC/CRF flange.
2 Remove 2 nuts, 2 bolts, and strap securing the lower tube to bracket on CRF/HPT flange.
3 Disconnect the coupling of the signal air tube to the IDG cooling air valve.
4 Disconnect the coupling clamp and misalignment fitting at compressor case and HPT case tubes. Remove the tube. Retain the seal.
(d)Remove the stage 7 LPT cooling air tube as follows :
1 Remove the nuts, bolts, loop clamps, and flat brackets securing the IDG valve signal air tube to the stage 7 LPT cooling tube.
2 Remove the nut, bolt, and double strap securing and separating the stage 7 LPT tube and HP recoup tube.
3 Remove the 2 nuts, 2 bolts, and strap securing the stage 7 LPT tube to the bracket on HPC/CRF flange. Rotate the loop clamp on the CDP tube.
4 Disconnect the tube at the coupling and misalignment fitting. Remove the tube. Retain the seal.
(e)Remove the HP recoup tube by disconnecting the 2 misalignment fittings.
(f)Remove the core cooling air tube as follows :
1 Remove the 2 nuts, 2 bolts, 2 washers, and strap securing the core cooling air tube to the bracket on the CRF/HPT flange.
2 Remove the cooling air tube by disconnecting at the one misalignment fitting.
(3)Remove the ignition leads (Ref. 74-21-01, P. Block 401).
(4)Remove the left and right fuel manifolds from the engine.

Pre SB GE 73-253*** (Engines with a drain manifold)

(a)Put a container below the fuel tee fitting and the two fuel supply hoses to catch fuel that will drain.
(b)Remove the tube clamps and the link brackets from the 5:00 position on the fuel manifold as follows :
1 Remove the nuts, washers, and bolts that attach the tube clamps and the link brackets to the engine (Ref. Fig. 405).
(c)Remove the bolts that attach the two heat shield shrouds to the aft side of the heat shield (Ref. Fig. 402).
(d)Move the two heat shield shrouds aft.
(e)Disconnect the fuel supply hoses from the left and the right fuel



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Right Side Cooling Manifold/Tubes
Figure 401

manifolds.
1 Drain the fuel into a container.
(f)Disconnect the fuel manifolds from the fuel nozzles as follows (Ref. Fig. 408) (Sheet 1/2) :
1 Disconnect the 30 tube nuts on the drain manifold.
2 Remove the safety wire and disconnect the knurled nuts from the 30 fuel nozzles.
3 Move each fuel nozzle drain shroud aft until you can see the tube nuts.
NOTE : You can disengage the shroud fittings from the fuel nozzles with a nylon drift, if necessary.
4 Disconnect the tube nuts that attach the fuel nozzle supply tubes to the fuel nozzles.
5 Remove and discard the preformed packings from the fuel nozzles and the fuel nozzle supply tubes.
(g)Disconnect the right fuel manifold from the left fuel manifold as follows :
1 At the 5:00 position, disconnect the tube nut that attaches the left fuel manifold to the right fuel manifold.
2 At the 11:00 position, disconnect the tube nut that attaches the left fuel manifold to the right fuel manifold.

Pre SB GE 73-170*** (Engines without friction dampening brackets)

(h)Remove the bolts that attach the loop clamps on the fuel manifolds to the 13 support brackets (Ref. Fig. 409) (Sheet 1/2).

End Pre SB GE 73-170

R (j)Disconnect the fuel drain manifold tube that goes through the heat shield from the left drain manifold.
NOTE : It is not necessary to remove the drain manifold from the engine when you replace the fuel manifolds.
CAUTION : MAKE SURE THAT YOU DO NOT BEND, TWIST, OR USE FORCE ON THE FUEL MANIFOLD WHEN YOU REMOVE IT. IF THE FUEL MANIFOLD IS CAUGHT ON A PART THAT EXTENDS FROM THE ENGINE, DO NOT USE FORCE. MOVE IT AROUND THE PART.
YOU MUST REMOVE IT CAREFULLY, OR YOU CAN CAUSE DAMAGE TO THE MANIFOLD.

R (k)Remove the right fuel manifold as follows :
1 Move the manifold in the aft direction.
2 Pull the manifold away from the engine in the 3 o'clock direction.

R (l)Remove the left fuel manifold as follows :
1 If you did the optional step to remove the components for better access to the left fuel manifold, do these steps :
- move the left fuel manifold in the aft direction.
- pull the left manifold away from the engine in the 9 o'clock direction.
2 If you did not do the optional step to remove the components, do these steps :
- move the left fuel manifold in the aft direction.
- turn the manifold to the right side of the engine until it is clear of the starter air duct.
- pull the left fuel manifold away from the engine in the 3 o'clock direction.

Pre SB GE 73-337

R (m)Remove the 30 retaining rings from the aft end of the fuel nozzle drain shrouds.

End Pre SB GE 73-337

Post SB GE 73-337

R (m)Remove the 30 snap rings from the aft end of the fuel nozzle drain shrouds.

End Post SB GE 73-337

R (n)Remove the 30 fuel nozzle drain shrouds from the fuel manifolds.

R (p)Remove and discard the loop clamps from the fuel manifolds.

R (q)Remove the two heat shield shrouds and rubber grommets from the fuel manifolds.

R (r)Install protective caps on all tube ends and open ports.

End Pre SB 73-253

Post SB GE 73-253*** (Engines without a drain manifold)

(a)Put a container below the fuel tee fitting and the two fuel supply hoses to catch fuel that will drain.

(b)Remove the tube clamps and the link brackets from the 5:00 position on the fuel manifold as follows :

1 Remove the nuts, washers, and bolts that attach the tube clamps and the link brackets to the engine (Ref. Fig. 406, 407).

(c)Remove the bolts that attach the two heat shield shrouds to the aft side of the heat shield (Ref. Fig. 402).

(d)Move the two heat shield shrouds aft.

(e)Disconnect the fuel supply hoses from the left and the right fuel manifolds.

1 Drain the fuel into a container.

(f)Disconnect the fuel manifolds from the fuel nozzles as follows (Ref. Fig. 408) (Sheet 2/2) :

1 Remove the safety wire from the knurled nuts.

2 Use soft-jawed pliers to disconnect the knurled nuts from the 30 fuel nozzles.

3 Move each fuel nozzle drain shroud aft until you can see the tube nuts.

NOTE : You can disengage the shroud fittings from the fuel nozzles with a nylon drift, if necessary.

4 Remove the safety wire and disconnect the tube nuts that attach the fuel nozzle supply tubes to the fuel nozzles.

5 Remove and discard the preformed packings from the fuel nozzles and the fuel nozzle supply tubes.

(g)Disconnect the right fuel manifold from the left fuel manifold as follows :

1 At the 5:00 position, disconnect the tube nut that attaches the left fuel manifold to the right fuel manifold.

2 At the 11:00 position, disconnect the tube nut that attaches the left fuel manifold to the right fuel manifold.

(h)Remove the bolts that attach each loop clamp to each of the 24 friction dampening brackets (Ref. Fig. 409) (Sheet 2/2).

CAUTION : MAKE SURE THAT YOU DO NOT BEND, TWIST, OR USE FORCE ON THE FUEL MANIFOLD WHEN YOU REMOVE IT. IF THE FUEL MANIFOLD IS CAUGHT ON A PART THAT EXTENDS FROM THE ENGINE, DO NOT USE

FORCE. MOVE IT AROUND THE PART.
YOU MUST REMOVE IT CAREFULLY, OR YOU CAN CAUSE DAMAGE TO THE MANIFOLD.

R (j)Remove the right fuel manifold as follows :
1 Move the manifold in the aft direction.
2 Pull the manifold away from the engine in the 3 o'clock direction.

R (k)Remove the left fuel manifold as follows :
1 If you did the optional step to remove the components for better access to the left fuel manifold, do these steps :
- move the left fuel manifold in the aft direction.
- pull the left manifold away from the engine in the 9 o'clock direction.

2 If you did not do the optional step for better access to the left fuel manifold, do these steps :
- move the left fuel manifold in the aft direction.
- turn the manifold to the right side of the engine until it is clear of the starter air duct.
- pull the left fuel manifold away from the engine in the 3 o'clock direction.

Pre SB GE 73-337

R (l)Remove the 30 retaining rings from the aft end of the fuel nozzle drain shrouds.

End Pre SB GE 73-337

Post SB GE 73-337

R (l)Remove the 30 snap rings from the aft end of the fuel nozzle drain shrouds.

End Post SB GE 73-337

R (m)Remove the 30 fuel nozzle drain shrouds from the fuel manifolds.

R (n)Remove and discard the loop clamps from the fuel manifolds.

R (p)Remove the two heat shield shrouds and rubber grommets from the fuel manifolds.

R (q)Install protective caps on all tube ends and open ports.

End Post SB GE 73-253

C. Visual Check for Silicone Adhesive PTFE Film Tape on Fuel Supply Manifolds

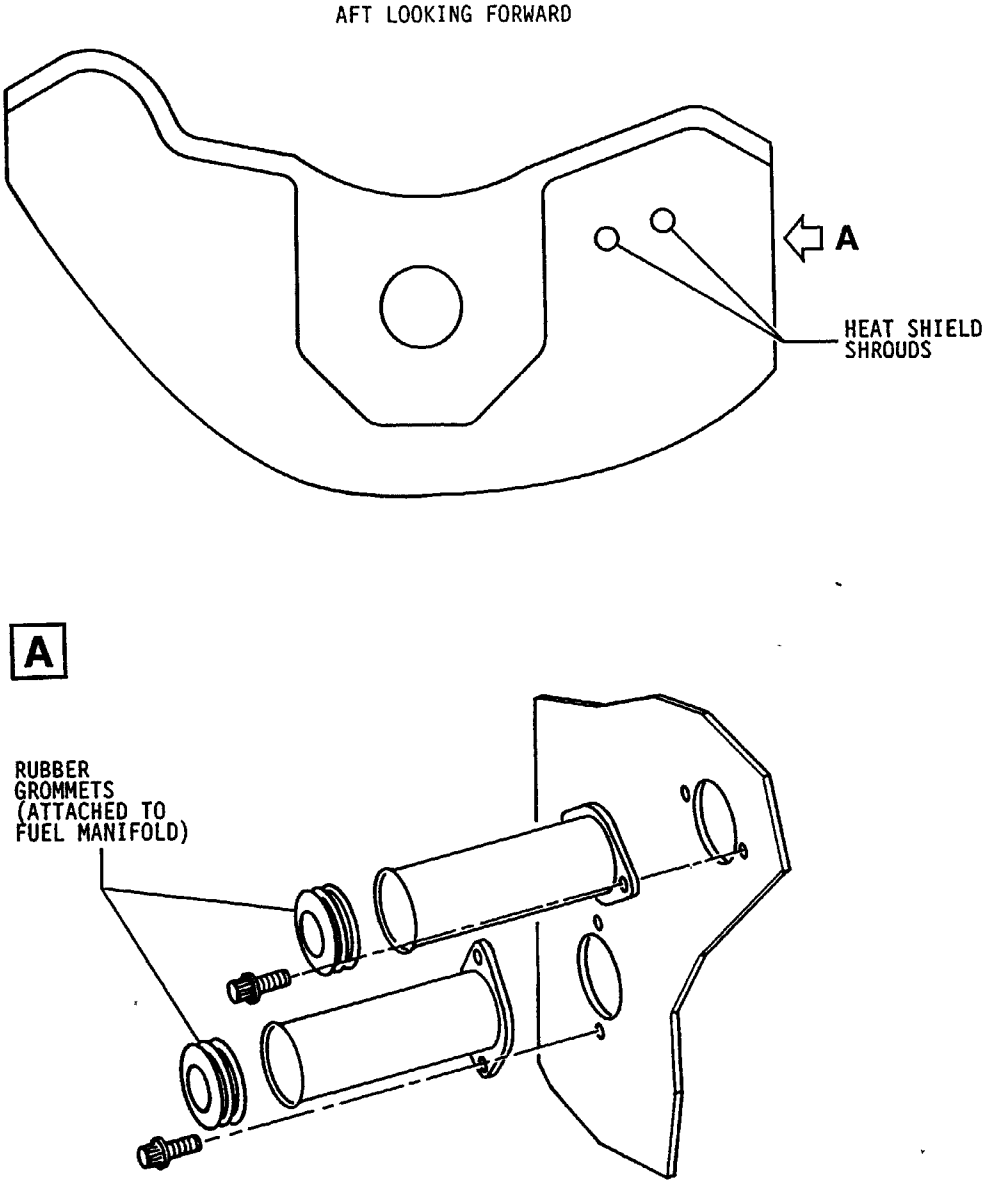
(1)Before you install the fuel supply manifolds, do a visual check to determine if silicone adhesive PTFE film tape (Material No. C10-230) has been applied to the manifolds as follows :

(a)If tape is present, do a visual inspection of the PTFE tape for correct tape adhesion. No visual evidence of unbonded areas between the PTFE tape and fuel manifolds is allowed.

(b)Do a visual inspection of the PTFE tape for tears and wrinkles. No tears or wrinkles are allowed (Ref. Fig. 404) for examples of incorrect PTFE tape application. Incorrect application of PTFE tape or tears and wrinkles can hamper the effectiveness of the tape.

(c)All silicone adhesive PTFE film tape that is not correctly applied or that is damaged must be replaced as follows :

1 Apply the PTFE tape to a clean fuel manifold at each cushioned clamp location. Dimensional data in (Ref. Fig. 403) can be used



BM5 73 13 03 4 LCMO - 01

Heat Shield Shroud Installation
Figure 402

if the fuel manifold is not installed on the engine. If the manifold is installed, use the mounting bracket as a guide for tape placement locations.

CAUTION : DO NOT APPLY MORE THAN THREE COMPLETE WRAPS OF PTFE TAPE AROUND THE FUEL SUPPLY MANIFOLD TUBE. MORE THAN THREE WRAPS WILL MAKE THE CUSHIONED CLAMP TOO TIGHT AND CAN AFFECT THE DAMPING EFFECT IN THE FUEL SUPPLY MANIFOLD.

2 Wrap one continuous piece of PTFE tape around the fuel manifold, applying two to three complete wraps. A PTFE tape length of 4.00 - 4.50 in. (101.6 - 114.3 mm) is a sufficient amount to wrap the manifold with 2 wraps of tape.

3 Make sure that the second and third wraps of PTFE tape are aligned with the previous wraps. Do not spiral wrap the PTFE tape (Ref. Fig. 404).

4 Push the PTFE tape tightly to ensure full contact around the complete diameter of the fuel supply manifold tube.

5 Do a visual inspection of the PTFE tape for correct adhesion. Make sure there are no unbonded areas between the PTFE tape and fuel supply manifolds.

D. Installation

CAUTION : BEFORE YOU INSTALL THE FUEL SUPPLY MANIFOLDS, VISUALLY INSPECT FOR PROPER ADHESION BETWEEN THE PTFE TAPE, (MATERIAL No. C10-230) AND THE FUEL SUPPLY MANIFOLDS. VISUALLY CHECK THE PTFE TAPE FOR TEARS AND WRINKLES. IMPROPER APPLICATION OF THE TAPE AND RIPS, TEARS, OR WRINKLES CAN HAMPER THE EFFECTIVENESS OF THE TAPE. REFER TO PARAGRAPH C. ABOVE.

Pre SB GE 73-253*** (Engines with a drain manifold)

(1)Put the left and right fuel manifold halves on the engine as follows :

Pre SB GE 73-337

(a)Install the 30 fuel nozzle drain shrouds and retaining rings on the fuel manifolds.

R (b)Not applicable.

R (c)Not applicable.

End Pre SB GE 73-337

Post SB GE 73-337

NOTE : SB GE 73-337 introduces new, more reliable snap rings that replace retaining rings.

R (a)Install the 30 fuel nozzle drain shrouds on the fuel manifolds.

R (b)Install the 30 snap rings inside the fuel nozzle shrouds as follows :

1 Make the locally manufactured installation tool (Ref. Fig. 407) (Sheet 3/9).

2 Install a snap ring inside the aft end of each fuel shroud (Ref. Fig. 407).

- Insert the ends of the snap ring into the fuel shroud at an angle and push snap ring into the fuel shroud. The shroud will compress the snap ring as it is inserted into the fuel shroud (Ref. Fig. 407) (Sheet 4/9).
- Use the installation tool to push the snap ring past the snap ring groove (Ref. Fig. 407) (Sheet 5/9).

- Hold the fuel manifold and the fuel shroud and pull them in the opposite directions. The fuel manifold preformed packing fitting will contact the snap ring (Ref. Fig. 407) (Sheet 6/9).
- Pull the fuel manifold and the fuel shroud slowly in opposite directions until the snap ring snaps into the groove.

NOTE : The snap ring has a tight tolerance fit with the groove in the fuel shroud. During installation, this tight tolerance may keep the snap ring from installing correctly in the fuel shroud groove. Inspection is required to make sure the snap ring is properly installed.

R (c)Do an inspection of the 30 snap rings using one of the following methods to make sure the snap rings are installed correctly :

1 Use a locally manufactured go/no-go inspection tool.
- Make the locally manufactured go/no-go inspection tool (Ref. Fig. 407) (Sheet 7/9).
- Insert the go/no-go inspection tool in the center of the snap ring (Ref. Fig. 407) (Sheet 8/9).
- Make sure that the go/no-go inspection tool is flush to the fuel shroud (Ref. Fig. 407) (Sheet 8/9, Detail A). Make sure that the snap ring is correctly seated in the snap ring groove and make sure the go/no-go inspection tool fits through inside diameter of the snap ring.

2 Use calipers to measure the snap ring inside diameter (Ref. Fig. 407) (Sheet 9/9).
- Measure the inside diameter of the snap ring in three places.
- The minimum dimension must be 0.717 in. (18.21 mm).

End Post SB GE 73-337

R (d)Install a rubber grommet on each of the two inlet tubes of the fuel manifolds.

R (e)Put the two heat shield shrouds in position on the inlet tubes.

R (f)Put the right fuel manifold on the engine.

R (g)If you did the optional step to remove the components for better access to the left manifold, do these steps :

1 Put the left fuel manifold on the engine.

R (h)If you did not do the optional step for better access to the left fuel manifold, do the steps that follow :

1 Put the left fuel manifold on the engine.
- make sure that the bottom end of the manifold is at the 5:30 position (aft looking forward).
- the fuel manifold must be between the engine and the starter air duct.

2 Turn the left fuel manifold to the left side of the engine until it is in the correct position.

(2)Install preformed packings on the fuel nozzles and fuel nozzle supply tubes as follows :

WARNING : LUBRICATING OIL IS AN AGENT THAT IS AN IRRITANT. MAKE SURE THAT ALL PERSONS OBEY ALL OF THE PRECAUTIONS WHEN LUBRICATING OIL IS USED. DO NOT USE IN AREAS WHERE THERE IS HIGH HEAT, SPARKS, OR FLAMES. USE IN AN AREA OPEN TO THE AIR. CLOSE THE CONTAINER WHEN NOT USED. DO NOT GET LUBRICATING OIL IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES. DO NOT BREATHE THE MIST.

(a)Lubricate the 60 preformed packings with Material No.C02-033.
(b)Install a preformed packing on each of the fuel nozzles.
(c)Install a preformed packing on each of the fuel nozzle supply tubes.
(3)Connect the fuel manifolds to the fuel nozzles as follows (Ref. Fig. 408) (Sheet 1/2) :
(a)Lubricate each tube nut fitting with Material No.C02-019.
(b)Tighten the tube nuts between the fuel nozzle supply tubes and the fuel nozzle drain shroud with your hand.
(4)Connect the right fuel manifold to the left fuel manifold as follows :
(a)At the 5:00 position, connect the tube nut that attaches the fuel manifolds.
1 TORQUE the tube nut to between 650 and 770 lbf.in. (7.34 and 8.70 m.daN).
2 Safety the tube nut with wire.
(b)At the 11:00 position, connect the tube nut that attaches the fuel manifolds.
1 TORQUE the tube nut to between 650 and 770 lbf.in. (7.34 and 8.70 m.daN).
2 Safety the tube nut with wire.
(5)Tighten the tube nuts that attach the fuel manifolds to the fuel nozzles as follows (Ref. Fig. 408) (Sheet 1/2) :
(a)TORQUE the tube nuts on the right fuel manifold to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN) as follows :
1 Tighten tube nut at fuel nozzle number 6 first.
2 Then tighten the tube nuts at each of the fuel nozzles in this sequence : 5, 7, 4, 8, 3, 9, 2, 10, 1, 11, 30, 12, 29 and 13.
(b)TORQUE the tube nuts on the left fuel manifold to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN) as follows :
1 Tighten the tube nut at fuel nozzle number 21 first.
2 Then tighten the tube nuts at each of the fuel nozzles in this sequence : 22, 20, 23, 19, 24, 18, 25, 17, 26, 16, 27, 15, 28 and 14.
(c)After 5 minutes, do a check of the torque value on the tube nuts.
(d)If necessary, do the steps to tighten the tube nuts again.
(e)After 5 minutes, do a check of the torque value on the tube nuts.
(f)If necessary, do the steps to tighten the tube nuts again.
NOTE : The procedure to tighten the tube nuts must be done again and again until the tube nuts stay at the correct torque value.

Pre SB GE 73-170 or 73-246*** (Engines without friction dampening brackets)

R (6)Install the new, zero-time loop clamps that attach the fuel manifold to the support brackets on the fuel nozzles as follows (Ref. Fig. 409) (Sheet 1/2) :
(a)Install the bolts to attach the 13 loop clamps to the brackets. If PTFE tape (Material No. C10-230) is installed on the fuel supply manifold, ensure that it extends past both edges of the loop clamps.
(b)TORQUE the bolts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).

End Pre SB GE 73-170 or 73-246

(7)Connect the tube nuts that attach the fuel manifolds to the fuel supply hoses.
(a)TORQUE the tube nuts to between 648 and 768 lbf.in. (7.32 and 8.68 m.daN).
(8)Install the bolts to attach the two heat shield shrouds to the aft side

of the heat shield (Ref. Fig. 402).
(a)TORQUE the bolts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(9)At the 5:00 position, install the tube clamps and the link brackets as follows :
(a)Install the nuts, washers, and bolts that attach the tube clamps and the link brackets to the engine (Ref. Fig. 405).
(b)TORQUE the nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(10)Do the fuel manifold leak check (Ref. 73-13-01, P. Block 401).
(11)Connect the fuel nozzle drain shrouds as follows :
(a)Move the fuel nozzle drain shrouds forward and align the connection between the drain manifold and each fuel nozzle drain shroud.
(b)Tighten the tube nut between the drain manifold and the fuel nozzle drain shroud with your hand.
(c)Tighten the knurled nut with your hand.
(d)TORQUE the tube nuts that attach the fuel nozzle drain shrouds to the drain manifold to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN).
(e)Tighten the 30 knurled nuts with soft-jawed pliers.
(f)Safety the knurled nuts to the fuel nozzles with wire.
(12)Install the drain tube that goes between the drain manifold and the heat shield.
(a)TORQUE the tube nut on the drain tube to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).
(13)Do the drain shroud and drain manifold leak check (Ref. 73-13-01, P. Block 401).
End Pre SB GE 73-253
Post SB GE 73-253*** (Engines without a drain manifold)
(1)Put the left and right fuel manifold halves on the engine as follows :
Pre SB GE 73-337
(a)Install the 30 fuel nozzle drain shrouds and retaining rings on the fuel manifolds.
R (b)Not applicable.
R (c)Not applicable.
End Pre SB GE 73-337
Post SB GE 73-337
NOTE : SB GE 73-337 introduces new, more reliable snap rings that replace retaining rings.
R (a)Install the 30 fuel nozzle drain shrouds on the fuel manifolds.
R (b)Install the 30 snap rings inside the fuel nozzle shrouds as follows :
1 Make the locally manufactured installation tool (Ref. Fig. 407) (Sheet 3/9).
2 Install a snap ring inside the aft end of each fuel shroud (Ref. Fig. 407).
- Insert the ends of the snap ring into the fuel shroud at an angle and push snap ring into the fuel shroud. The shroud will compress the snap ring as it is inserted into the fuel shroud (Ref. Fig. 407) (Sheet 4/9).
- Use the installation tool to push the snap ring past the snap ring groove (Ref. Fig. 407) (Sheet 5/9).
- Hold the fuel manifold and the fuel shroud and pull them in the opposite directions. The fuel manifold preformed packing fitting will contact the snap ring (Ref. Fig. 407) (Sheet 6/9).

- Pull the fuel manifold and the fuel shroud slowly in opposite directions until the snap ring snaps into the groove.

NOTE : The snap ring has a tight tolerance fit with the groove in the fuel shroud. During installation, this tight tolerance may keep the snap ring from installing correctly in the fuel shroud groove. Inspection is required to make sure the snap ring is properly installed.

R (c)Do an inspection of the 30 snap rings using one of the following methods to make sure the snap rings are installed correctly :

1 Use a locally manufactured go/no-go inspection tool.

- Make the locally manufactured go/no-go inspection tool (Ref. Fig. 407) (Sheet 7/9).
- Insert the go/no-go inspection tool in the center of the snap ring (Ref. Fig. 407) (Sheet 8/9).
- Make sure that the go/no-go inspection tool is flush to the fuel shroud (Ref. Fig. 407) (Sheet 8/9, Detail A). Make sure that the snap ring is correctly seated in the snap ring groove and make sure the go/no-go inspection tool fits through inside diameter of the snap ring.

2 Use calipers to measure the snap ring inside diameter (Ref. Fig. 407) (Sheet 9/9).

- Measure the inside diameter of the snap ring in three places.
- The minimum dimension must be 0.717 in. (18.21 mm).

End Post SB GE 73-337

R (d)Install a rubber grommet on each of the two inlet tubes of the fuel manifolds.

R (e)Put the two heat shield shrouds in position on the inlet tubes.

R (f)Put the right fuel manifold on the engine.

R (g)If you did not do the optional step for better access to the left fuel manifold, do the steps that follow :

1 Put the left fuel manifold on the engine.

- Make sure that the bottom end of the manifold is at the 5:30 position (aft to forward).
- The fuel manifold must be between the engine and the starter air duct.

2 Turn the left fuel manifold to the left side of the engine until it is in the correct position.

R (h)If you did the optional step to remove the components for better access, put the left fuel manifold on the engine.

(2)Install preformed packings on the fuel nozzles and fuel nozzle supply tubes as follows :

WARNING : LUBRICATING OIL IS AN AGENT THAT IS AN IRRITANT. MAKE SURE THAT ALL PERSONS OBEY ALL THE PRECAUTIONS WHEN LUBRICATING OIL IS USED. DO NOT USE IN VERY HOT AREAS, WHERE THERE ARE SPARKS, OR FLAMES. USE IN AN AREA OPEN TO THE AIR. CLOSE THE CONTAINER WHEN NOT USED. DO NOT GET LUBRICATING OIL IN THE EYES, ON THE SKIN, OR ON YOUR CLOTHES. DO NOT BREATHE THE MIST.

(a)Lubricate the 60 preformed packings with Material No.C02-033.

(b)Install a preformed packing on each of the fuel nozzles.

(c)Install a preformed packing on each of the fuel nozzle supply tubes.

(3)Connect the fuel manifolds to the fuel nozzles as follows (Ref. Fig. 408) (Sheet 2/2) :
(a)Lubricate each tube nut fitting with Material No.C02-019.
(b)Tighten the tube nuts between the fuel nozzle supply tubes and the fuel nozzle drain shroud with your hand.
(4)Connect the right fuel manifold to the left fuel manifold as follows :
(a)At the 5:00 position, connect the tube nut that attaches the fuel manifolds.
1 TORQUE the tube nut to between 650 and 770 lbf.in. (7.35 and 8.70 m.daN).
2 Safety the tube nut with wire.
(b)At the 11:00 position, connect the tube nut that attaches the fuel manifolds.
1 TORQUE the tube nut to between 650 and 770 lbf.in. (7.35 and 8.70 m.daN).
2 Safety the tube nut with wire.
(5)TORQUE the tube nuts that connect the fuel manifolds to the fuel nozzles to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN) as follows (Ref. Fig. 408) (Sheet 2/2) :
(a)TORQUE the tube nuts to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).
(b)Loosen the tube nuts.
(c)TORQUE the tube nuts to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN) a second time.
(d)Loosen the tube nuts.
(e)TORQUE the tube nuts to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN) a third time.
(6)Attach the fuel manifolds to the 24 friction dampening brackets as follows :
R NOTE : Use new, zero-time loop clamps that attach the fuel manifolds to
R the 24 friction dampening brackets.
(a)Install a bolt to each fuel manifold loop clamp.
If PTFE tape (Material No. C10-230) is installed on the fuel supply manifold, ensure that it extends past both edges of the loop clamps.
(b)TORQUE the bolts to between 50 and 56 lbf.in. (0.56 and 0.63 m.daN).
(7)Connect the tube nuts that attach the fuel manifolds to the fuel supply hoses.
(a)TORQUE the tube nuts to between 648 and 768 lbf.in. (7.32 and 8.68 m.daN).
(8)Install the two bolts to attach the two heat shield shrouds to the aft side of the heat shield (Ref. Fig. 402) :
(a)TORQUE the bolts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(9)At the 5:00 position, install the tube clamps and the link brackets as follows :
(a)Install the nuts, washers, and bolts that attach the tube clamps and the link brackets to the engine (Ref. Fig. 406, 407).
1 TORQUE the nuts to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(10)Do a fuel manifold leak check (Ref. 73-13-01, P. Block 401).
(11)Safety the 30 tube nuts that attach the fuel nozzle supply tubes to the fuel nozzles with wire.
NOTE : Safety cable cannot be used on the tube nuts because of the

minimum clearance between the tube nuts and the fuel nozzle drain shrouds.

(12)Connect the fuel nozzle drain shrouds to the fuel nozzles.

(a)Tighten the 30 knurled nuts with soft-jawed pliers.

(b)Safety the knurled nuts to the fuel nozzles with wire.

End Post SB GE 73-253

(13)Installation of right side cooling air tubing.

NOTE : As tubes are installed, all end fittings and clamps must be tightened fingertight. After the complete system is installed, tighten clamps first, then end fittings.

(a)Install the lower HPT cooling tube as follows :

1 Position the lower HPT cooling tube between the connection ports of the compressor case and HPT fitting.

2 Install a seal and coupling clamp at the compressor case connection. Connect to the misalignment fitting of the HPT connection. Tighten both handtight.

3 Secure the tube to bracket on HPC/CRF flange with strap, 2 bolts, and 2 nuts. Tighten fingertight.

4 Secure tube to bracket on CRF/HPT flange with strap, 2 bolts, and 2 nuts.

5 TORQUE the 4 strap nuts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).

6 TORQUE the coupling clamp nut to a final torque of 45 lbf.in. (0.5 m.daN) (Ref. 70-00-00, P. Block 201).

7 TORQUE the misalignment fitting to between 600 and 720 lbf.in. (6.77 and 8.13 m.daN) and wirelock.

8 Connect the IDG cooling valve signal tube to fitting on the HPT cooling tube. Tighten fingertight at this time.

(b)Position the HP recoup between the connection of the CRF and LPT tee tube. TORQUE the misalignment fittings to between 600 and 720 lbf.in. (6.77 and 8.13 m.daN) and wirelock.

(c)Install the stage 7 LPT cooling tube as follows :

1 Position the stage 7 LPT cooling tube between the connections on the compressor case and the LPT manifold.

2 Install seal at the compressor case connection and secure with a coupling clamp. Connect at the misalignment fitting of the LPT manifold. Tighten both by hand.

3 Secure the LPT tube and a CDP tube loop clamp to bracket on HPC/CRF flange with strap, 2 bolts, and 2 nuts. Tighten fingertight.

4 Install a set of straps across the LPT tube and the HP recoup tube. Secure together with a bolt and nut.

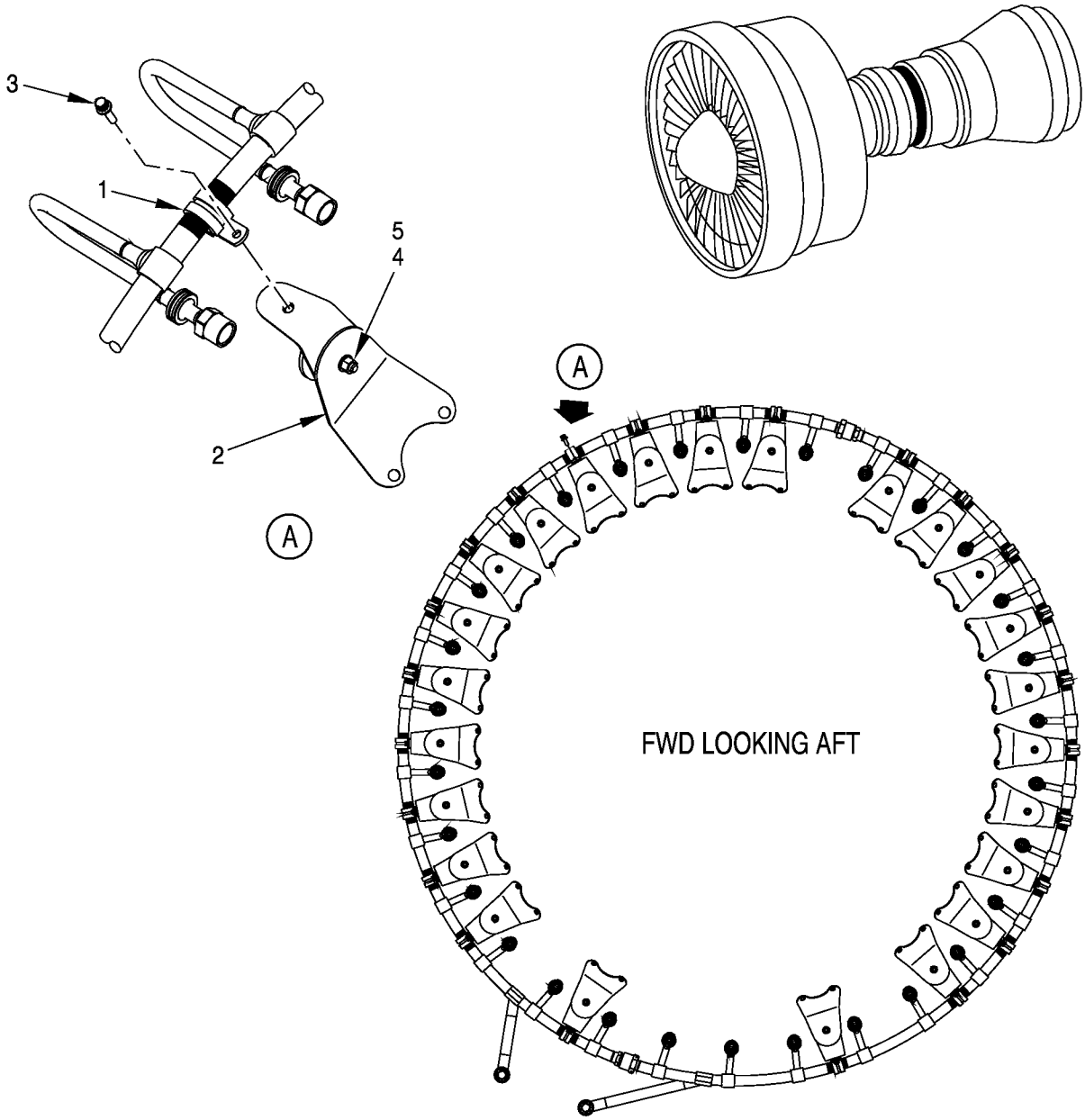
5 TORQUE the 3 strap nuts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).

6 TORQUE the coupling clamp to 45 lbf.in. (0.5 m.daN) (Ref. 70-00-00, P. Block 201).

7 TORQUE the misalignment fittings to between 600 and 720 lbf.in. (6.77 and 8.13 m.daN) and wirelock.

Pre SB GE 72-283

(d)Secure the IDG cooling air valve signal air tube to the stage 7 LPT cooling air tube using 2 bolts, one loop clamp, one flat bracket, one

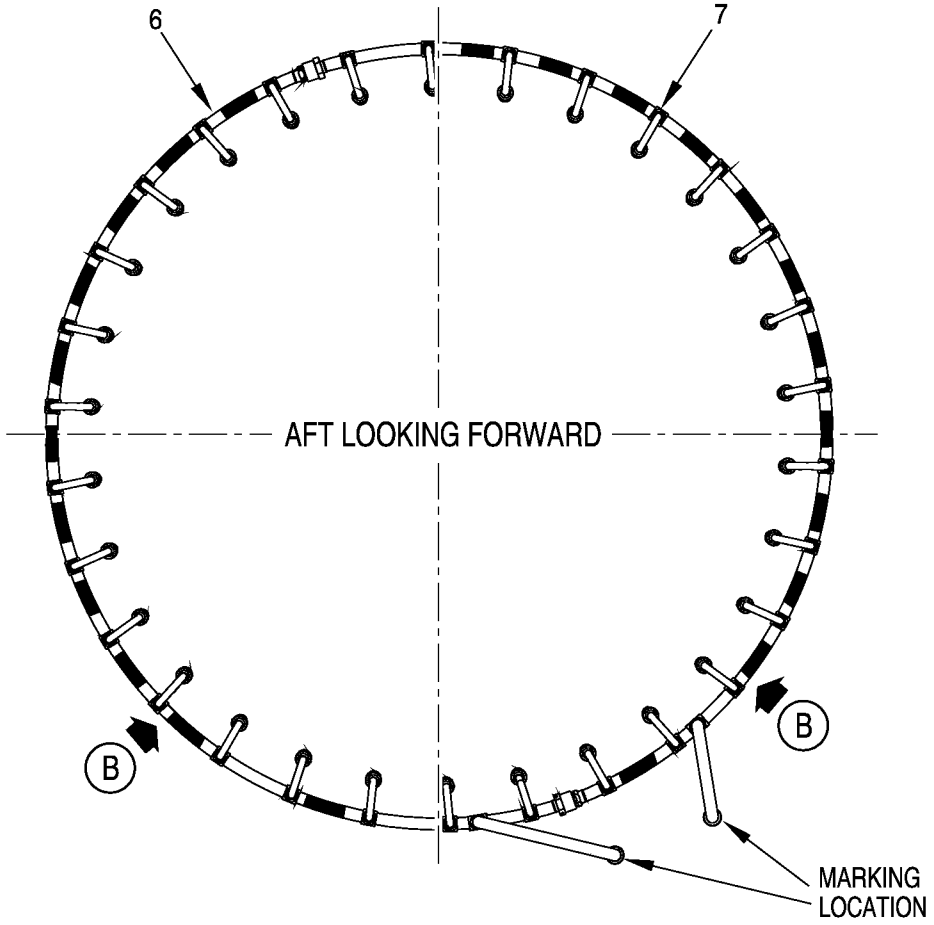


BM5 73 13 03 4 LMMA 00

LEGEND:
1. CUSHIONED CLAMP
2. BRACKET
3. BOLT
4. BOLT
5. NUT

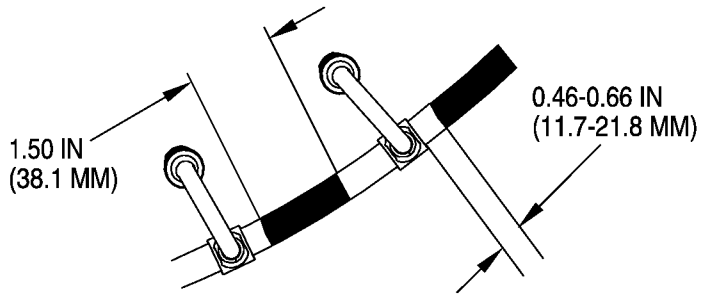
1270471-00

PTFE Tape Locations (Sheet 1/2)
Figure 403



LEGEND:
6. FUEL LEFT SIDE MANIFOLD
REWORK TO P/N 2420M70G01
OR P/N 2420M72G01
7. FUEL RIGHT SIDE MANIFOLD
REWORK TO P/N 2420M71G01
OR P/N 2420M73G01

NOTE:
ZONES WITH SHADOWS REPRESENT
CLAMP LOCATIONS WRAPPED WITH PTFE TAPE.
BRACKETS NOT SHOWN FOR CLARITY.

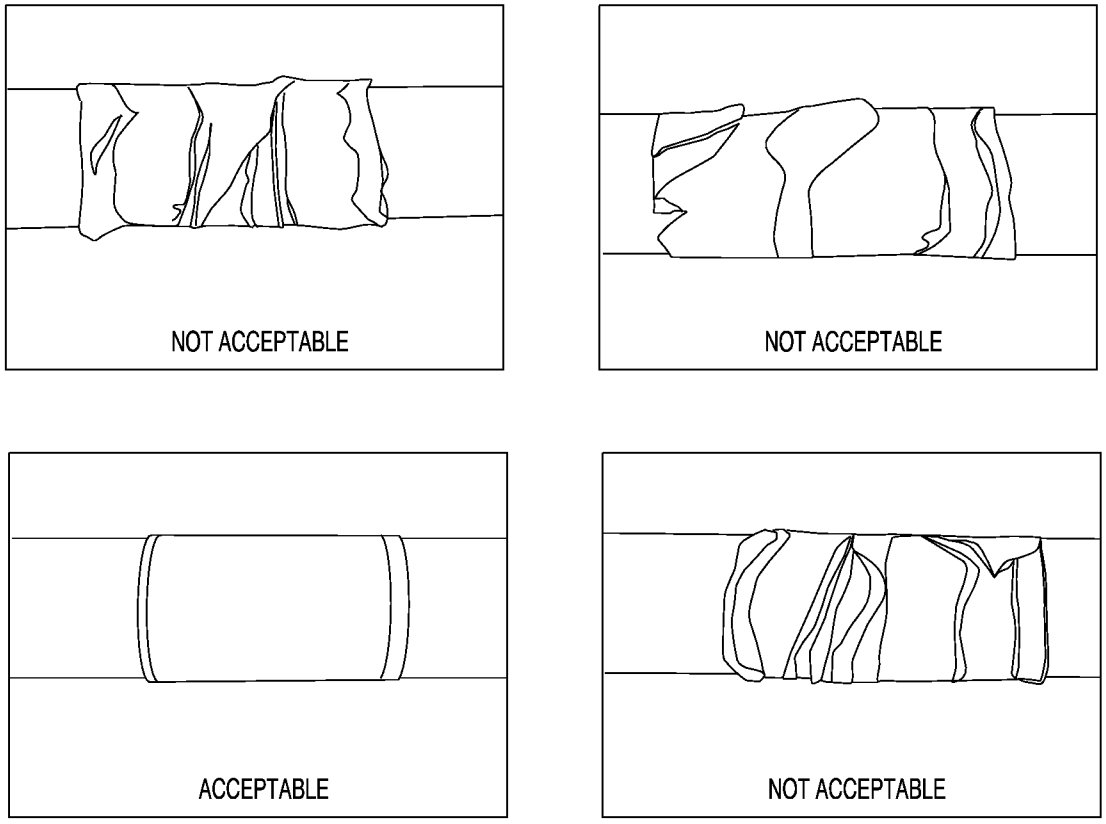


B
AFT LOOKING FORWARD

1270472-00

BM5 73 13 03 4 LMMJ 00

PTFE Tape Locations (Sheet 2/2)
Figure 403



WRINKLE, RIPS, TEARS, SPIRAL WRAP ARE NOT ACCEPTABLE TAPE APPLICATIONS

BM5 73 13 03 4 LPM0 00

12670463-00

Tape Application
Figure 404

washer, and 2 nuts.
TORQUE nuts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
End PRE SB GE 72-283
SB GE 72-283

(d)Secure the IDG cooling air valve signal air tube to stage 7 LPT cooling air tube using 4 bolts, 2 split bushings on signal tube, 4 split bushings on stage 7 LPT tube, 2 loop clamps, 4 flat brackets, and 4 nuts. TORQUE nuts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
End SB GE 72-283

(e)TORQUE the IDG cooling air valve signal tube to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).

(f)Install the upper HPT cooling tube as follows :

1 Position the HPT cooling tube between the connections on the CRF and the fitting on the HPT case.

2 Install a seal and coupling clamp to the CRF connection and tighten fingertight. Connect at the HPT misalignment fitting and tighten fingertight.

3 Secure and separate the upper and lower HPT cooling tubes using 2 straps, one bolt, and one nut. Tighten nut fingertight.

4 Secure the HPT cooling tube to bracket on CRF/HPT flange using one strap, 2 bolts, and 2 nuts. Tighten fingertight.

5 Secure the HPT cooling tube to bracket on the HPC/CRF flange using one strap, 2 bolts, one flat bracket, 2 washers, and 2 nuts. Tighten fingertight.

6 TORQUE the 5 strap nuts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).

7 TORQUE the coupling clamp to 45 lbf.in. (0.5 m.daN).

8 TORQUE the misalignment fittings to between 600 and 720 lbf.in. (6.77 and 8.13 m.daN) and wirelock.

(g)Install the LPT case cooling manifold as follows :

1 Position the LPT case cooling manifold between the LPT cooling air valve and HPT/LPT inlet manifold.

2 Secure at the cooling air valve with a coupling clamp. Secure at the HPT/LPT inlet manifold with a seal and a coupling clamp. Tighten fingertight.

3 Secure to bracket on HPC/CRF flange using one strap, 2 bolts, 2 washers, and 2 nuts.

4 TORQUE strap nuts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).

5 TORQUE the 2 coupling clamps to between 50 lbf.in. (0.56 m.daN) (Ref. 70-00-00, P. Block 201).

(h)Install the core cooling tube as follows :

1 Position the core cooling tube onto the cooling air manifold and connect at the misalignment fitting fingertight.

2 Secure tube to bracket on CRF/HPT flange using one strap, 2 bolts, 2 washers, and 2 nuts.

3 TORQUE strap nuts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).

4 TORQUE the misalignment fitting to between 480 and 600 lbf.in. (5.42 and 6.77 m.daN) and wirelock.

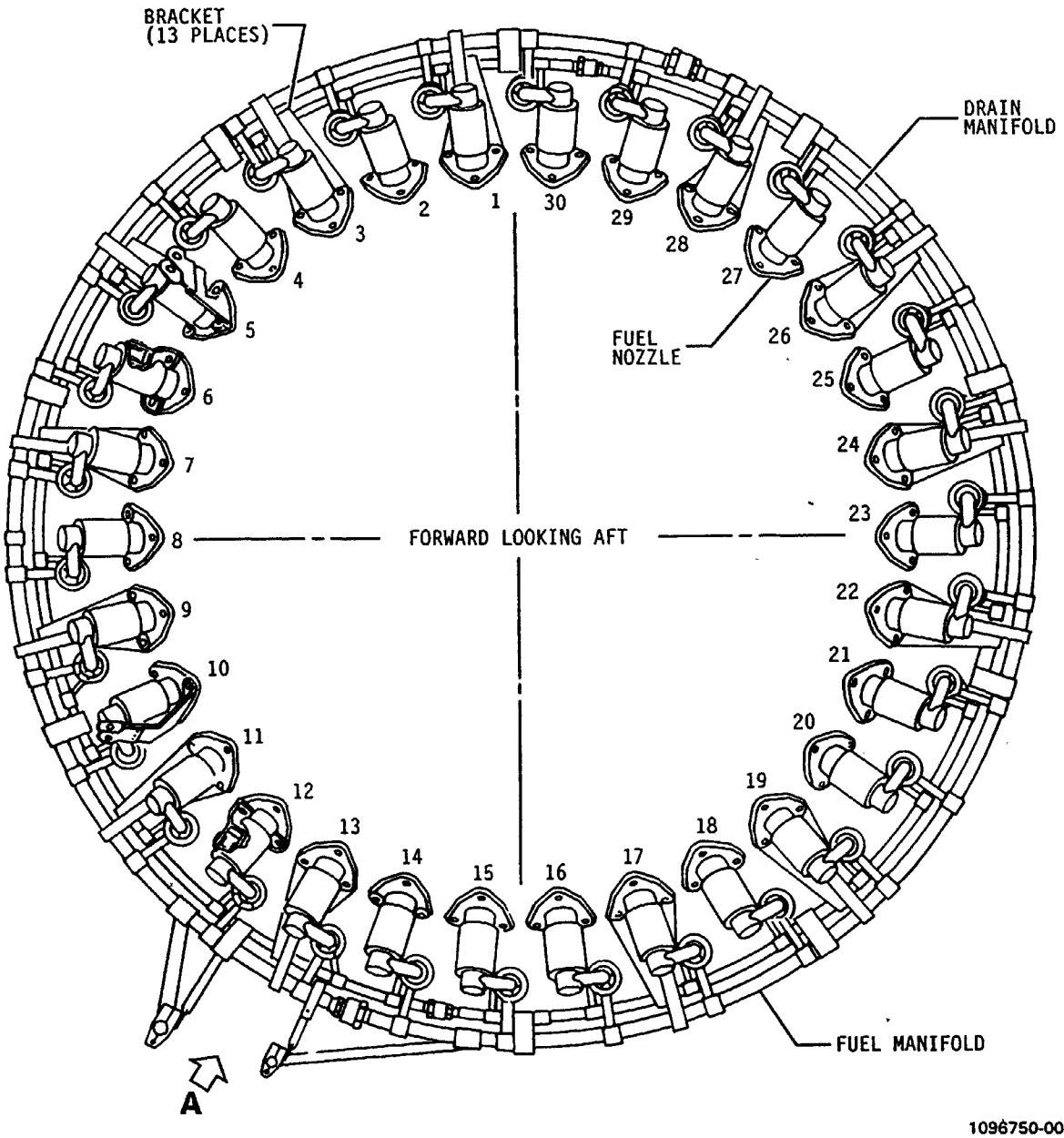
R (j)Install the ignition leads.

R (k)Perform a leak check on the pneumatic tubes.

(14)Install QEC equipment removed to facilitate removal of the fuel mani-

folds.

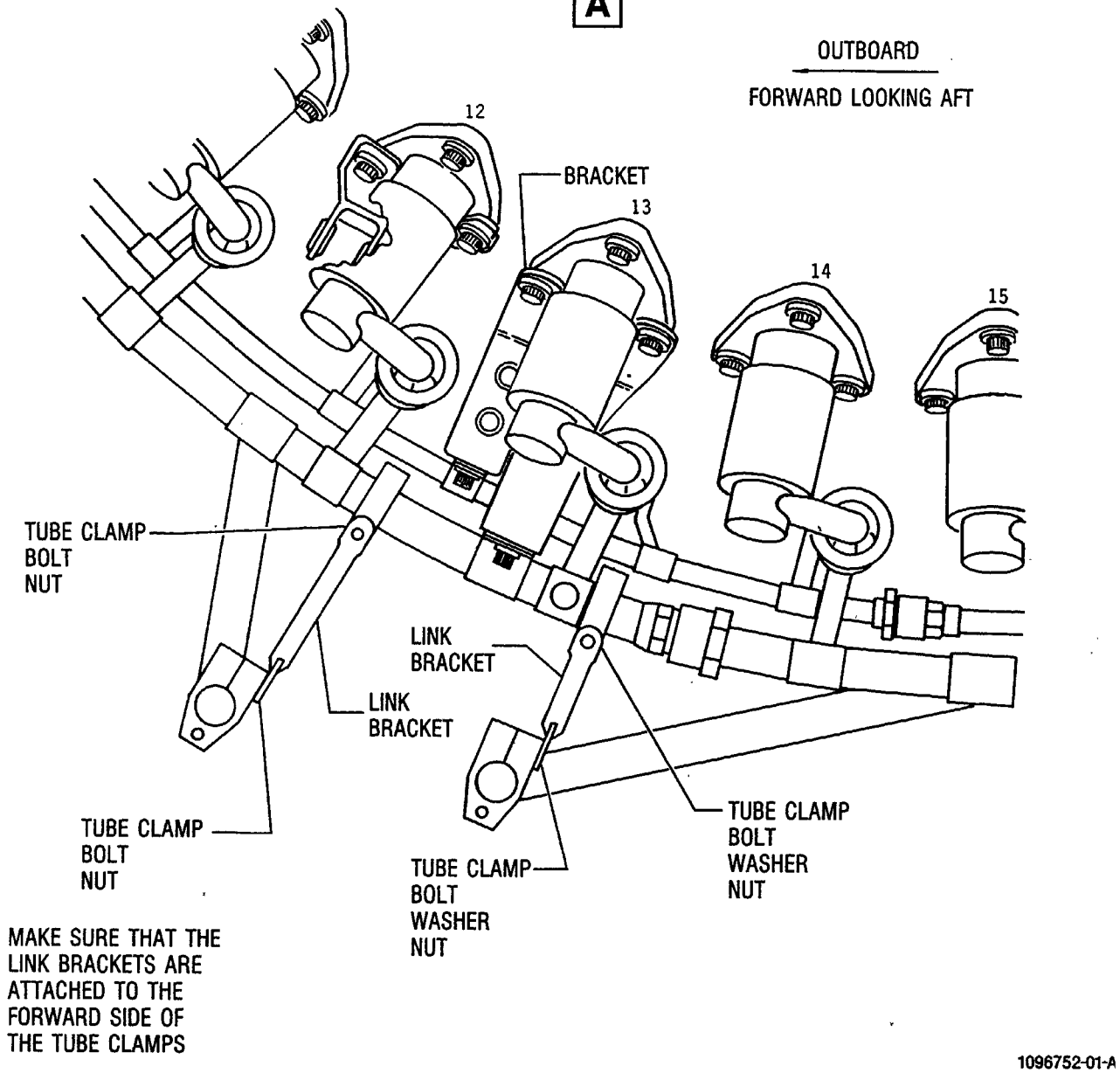
E. Close-Up and Test
(1)Close the core cowl doors, fan reverser cowl doors, and fan cowl doors (Ref. 71-13-00, P. Block 301).
(2)Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501).



1096750-00-A

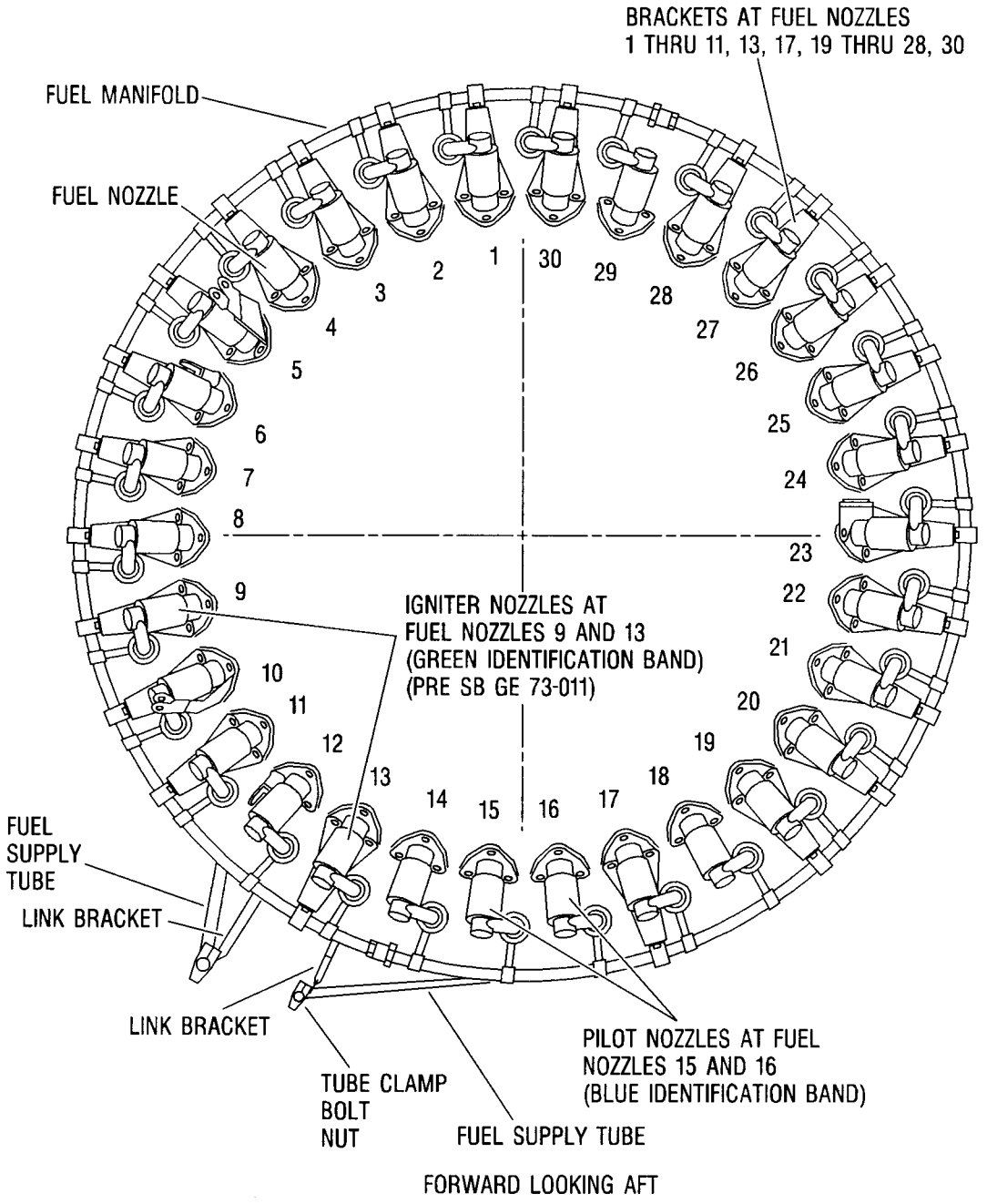
BM5 73 13 03 4 LEMA - 00

Fuel Manifold Installation (Pre SB GE 73-253 and Pre SB GE 73-170) (Sheet 1/2)
Figure 405



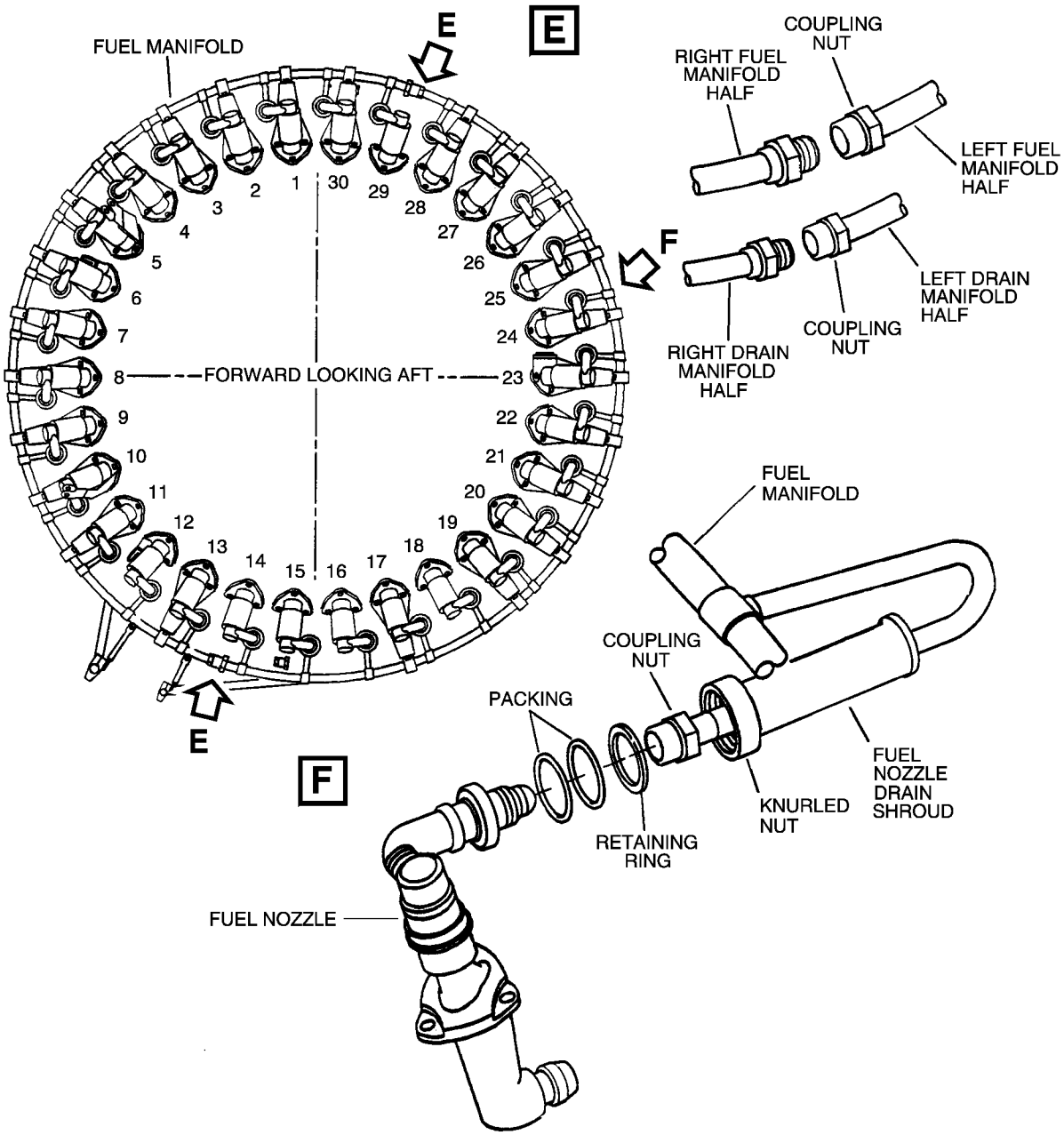
BM5 73 13 03 4 LEMJ - 00

Fuel Manifold Installation (Pre SB GE 73-253 and Pre SB GE 73-170) (Sheet 2/2)
Figure 405



BM5 73 13 03 4 LJMO 01

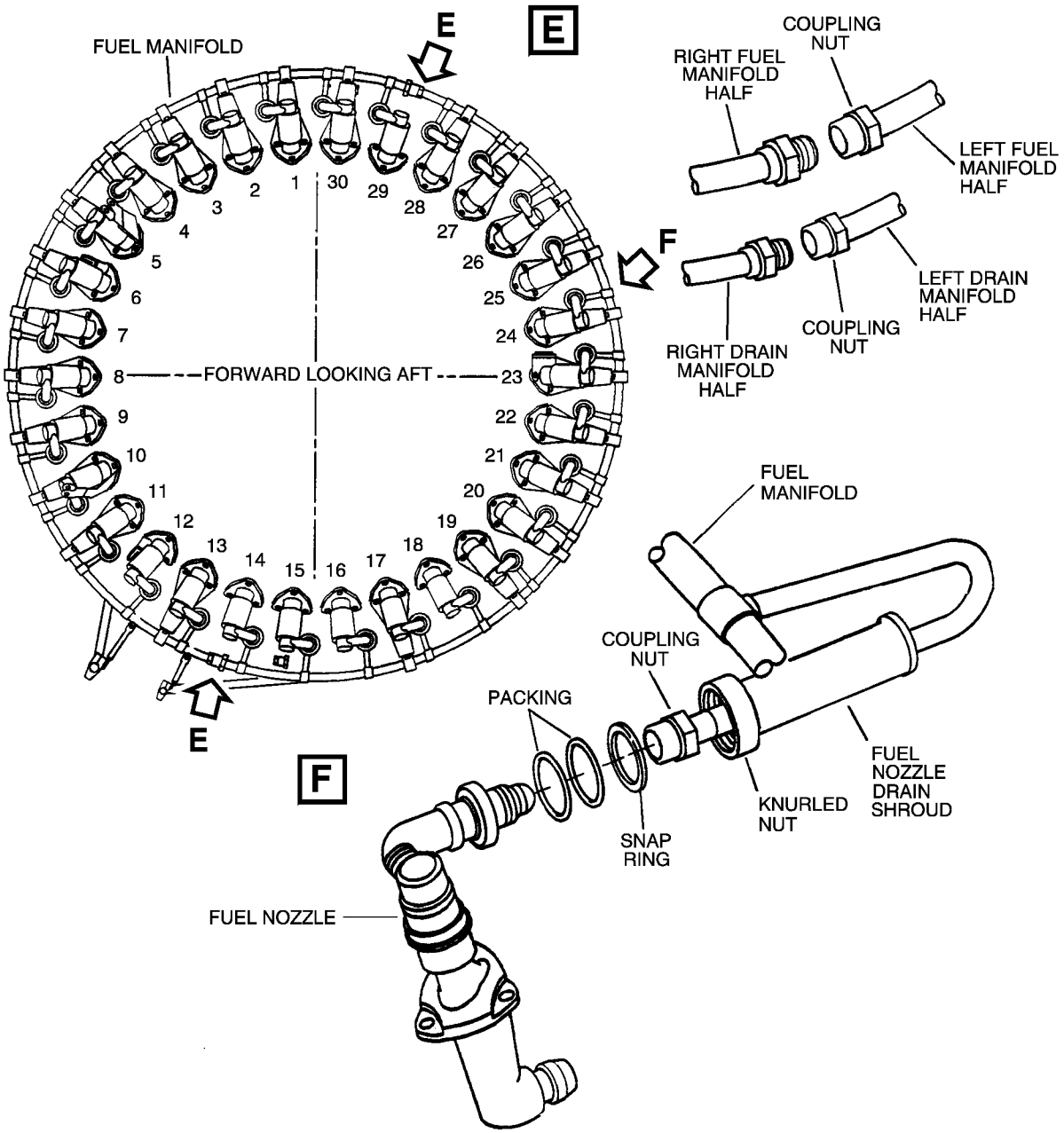
Fuel Manifold Installation (Post SB GE 73-253)
Figure 406



BM5 73 13 03 4 LKMA 00

1151816-00-A

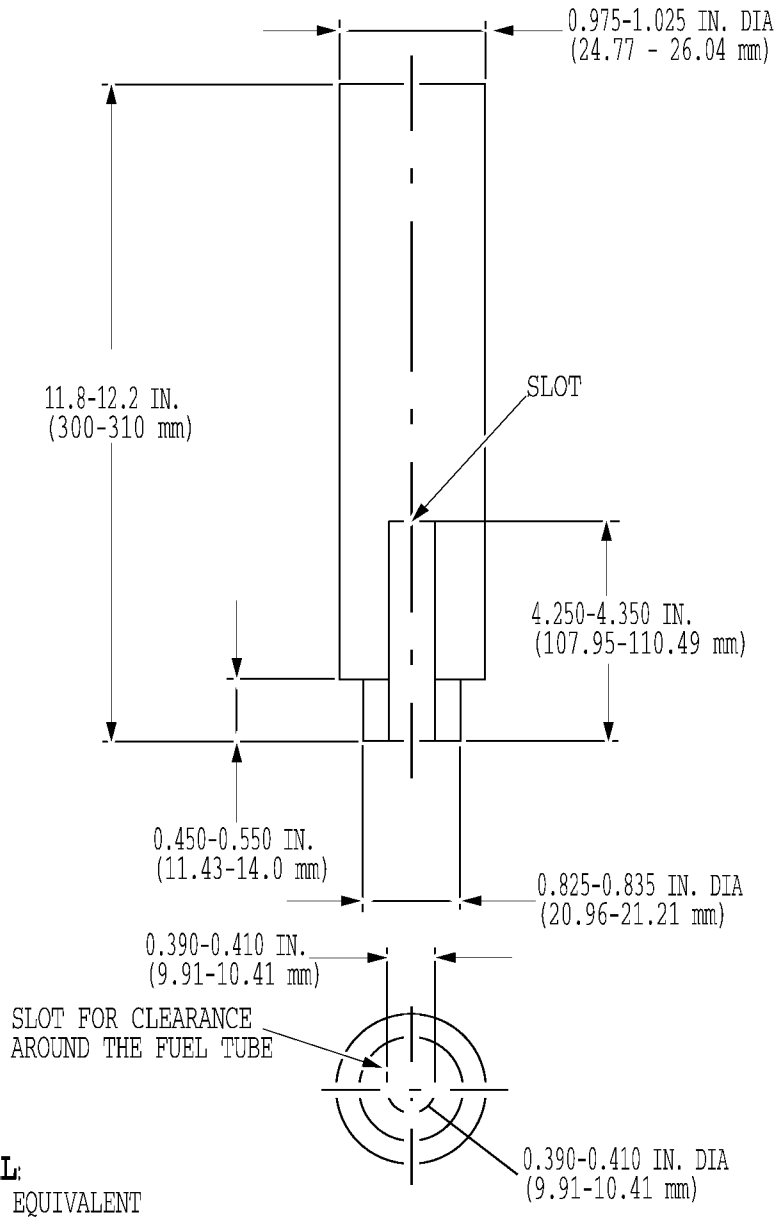
Fuel Manifold Installation (Post SB GE 73-253 and Pre SB GE 73-337) (Sheet 1/9)
Figure 407



BM5 73 13 03 4 LKMB 00

1151816-00-A

Fuel Manifold Installation (Post SB GE 73-253 and Post SB GE 73-337) (Sheet 2/9)
Figure 407

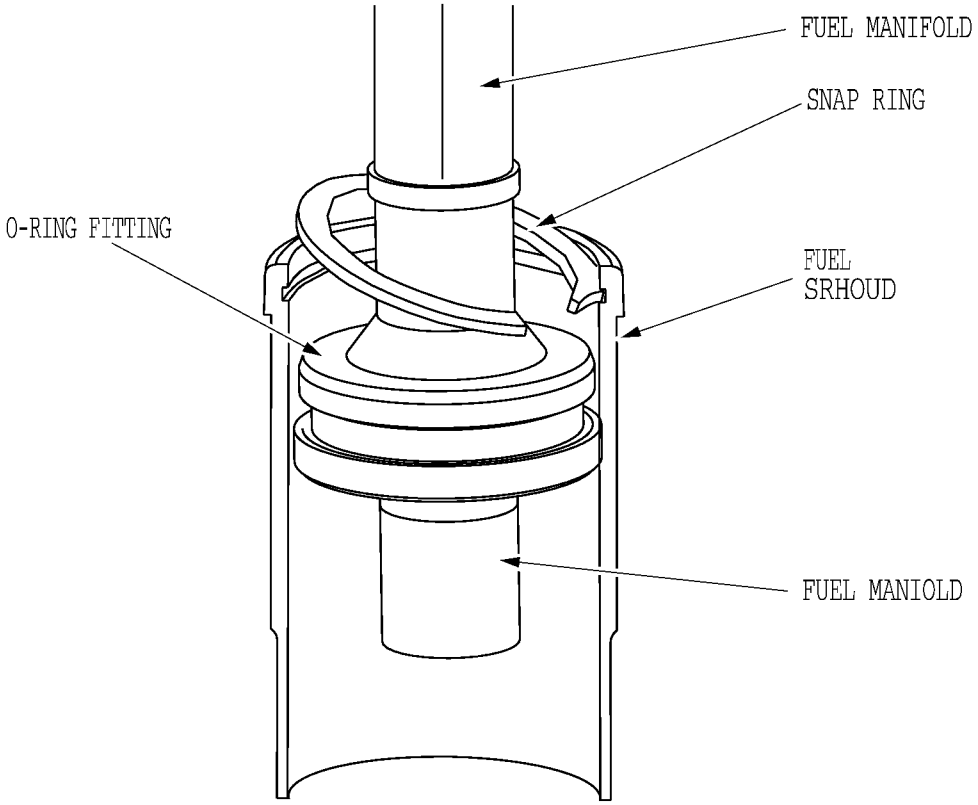


MATERIAL:
TEFLON OR EQUIVALENT

1236687-00-A

BM5 731303 4 LKMC 00

Fuel Manifold Installation (Post SB GE 73-337)
(Sheet 3/9)
Figure 407

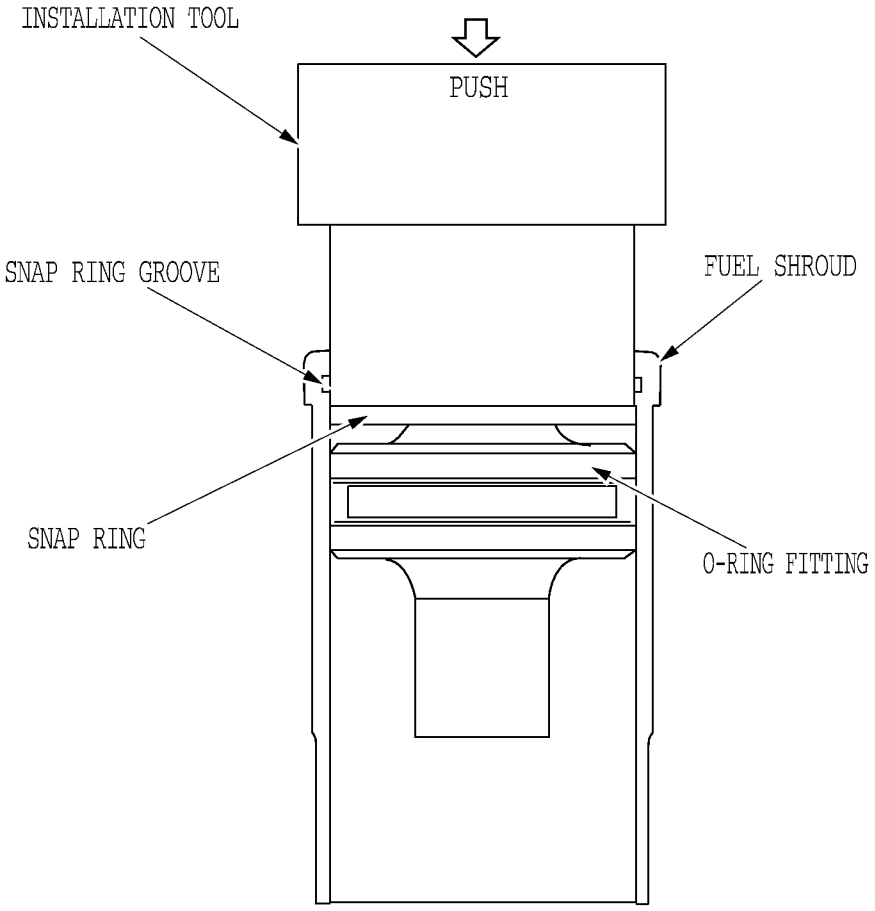


SNAP RING POSITIONING WITH INSTALLATION TOOL

1236680-00-A

BM5 731303 4 LKMD 00

Fuel Manifold Installation (Post SB GE 73-337)
(Sheet 4/9)
Figure 407

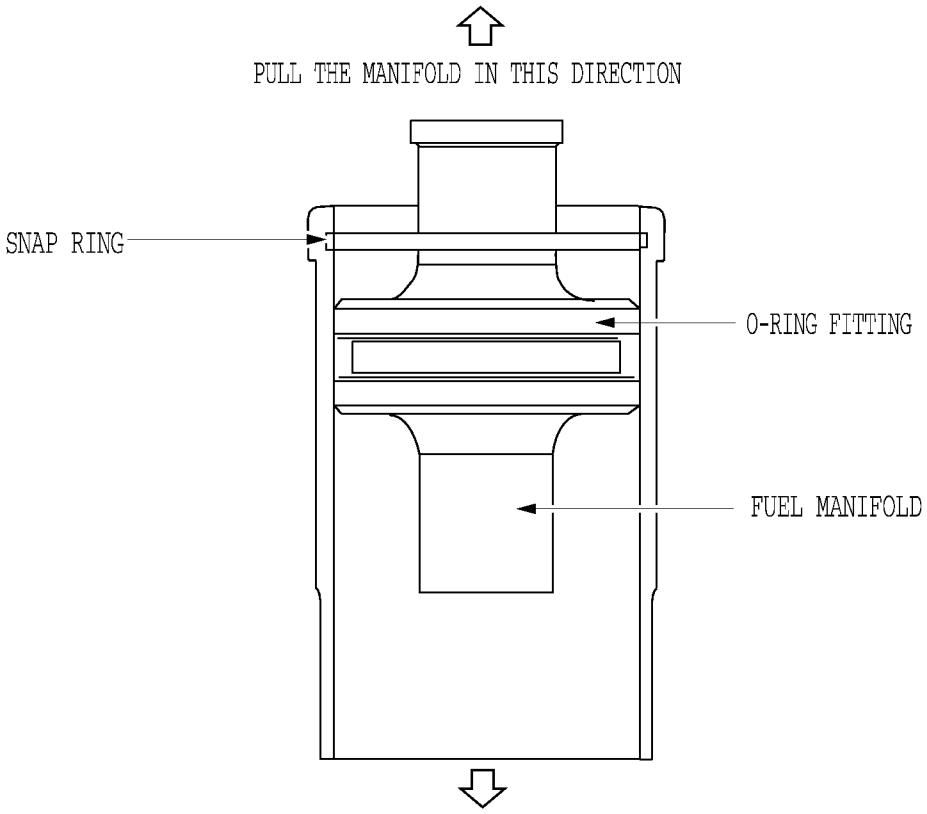


SNAP RING POSITIONING WITH INSTALLATION TOOL

1236681-00-A

BM5 731303 4 LKME 00

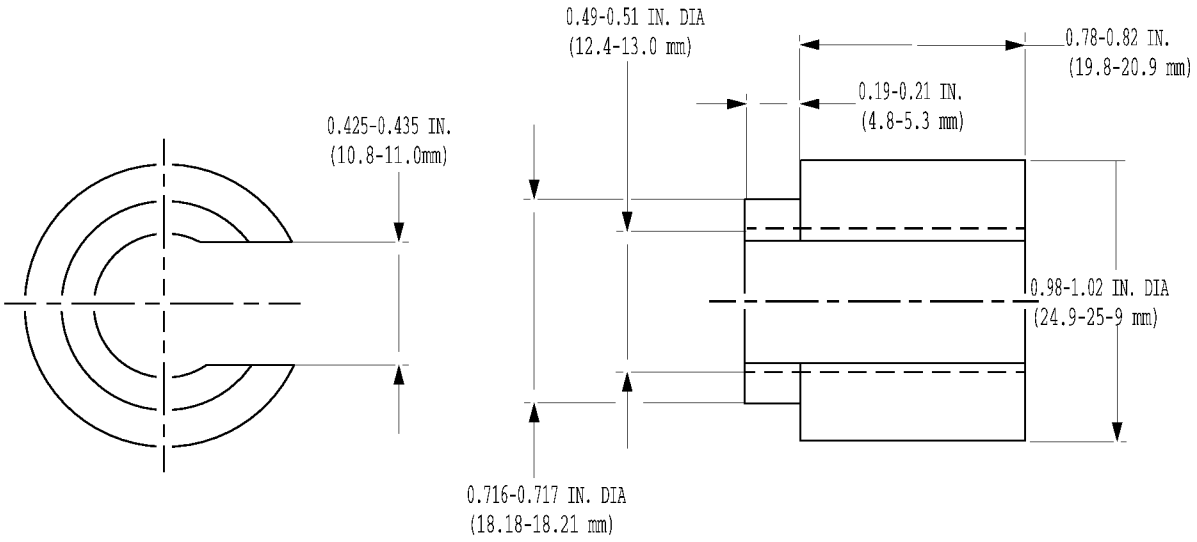
Fuel Manifold Installation (Post SB GE 73-337)
(Sheet 5/9)
Figure 407



1236683-00-A

BM5 731303 4 LKMF 00

Fuel Manifold Installation (Post SB GE 73-337)
(Sheet 6/9)
Figure 407



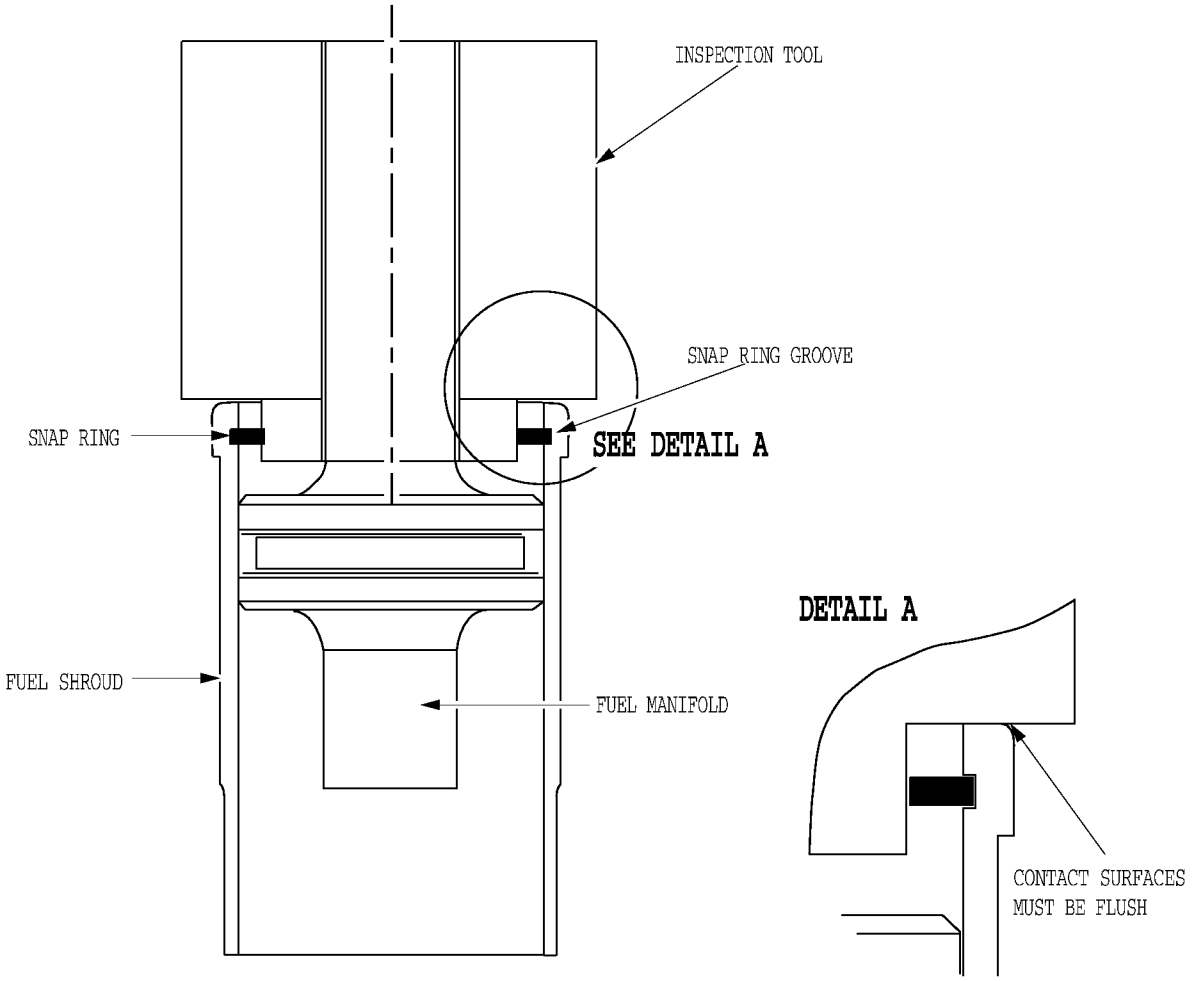
INSPECTION TOOL

MATERIAL:
-SAE 410-4142
-Rc 34-38

1236686-00-A

BM5 731303 4 LKMG 00

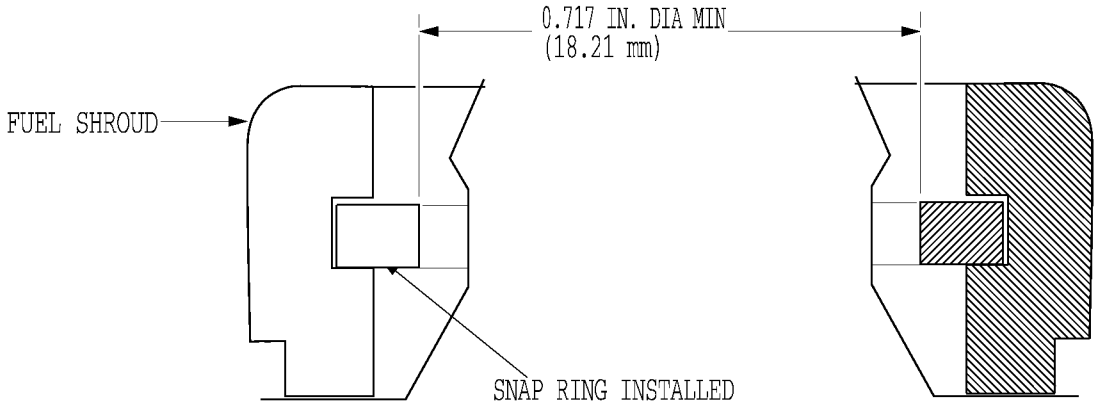
Fuel Manifold Installation (Post SB GE 73-337)
(Sheet 7/9)
Figure 407



1236685-00-B

BM5 731303 4 LKMH 00

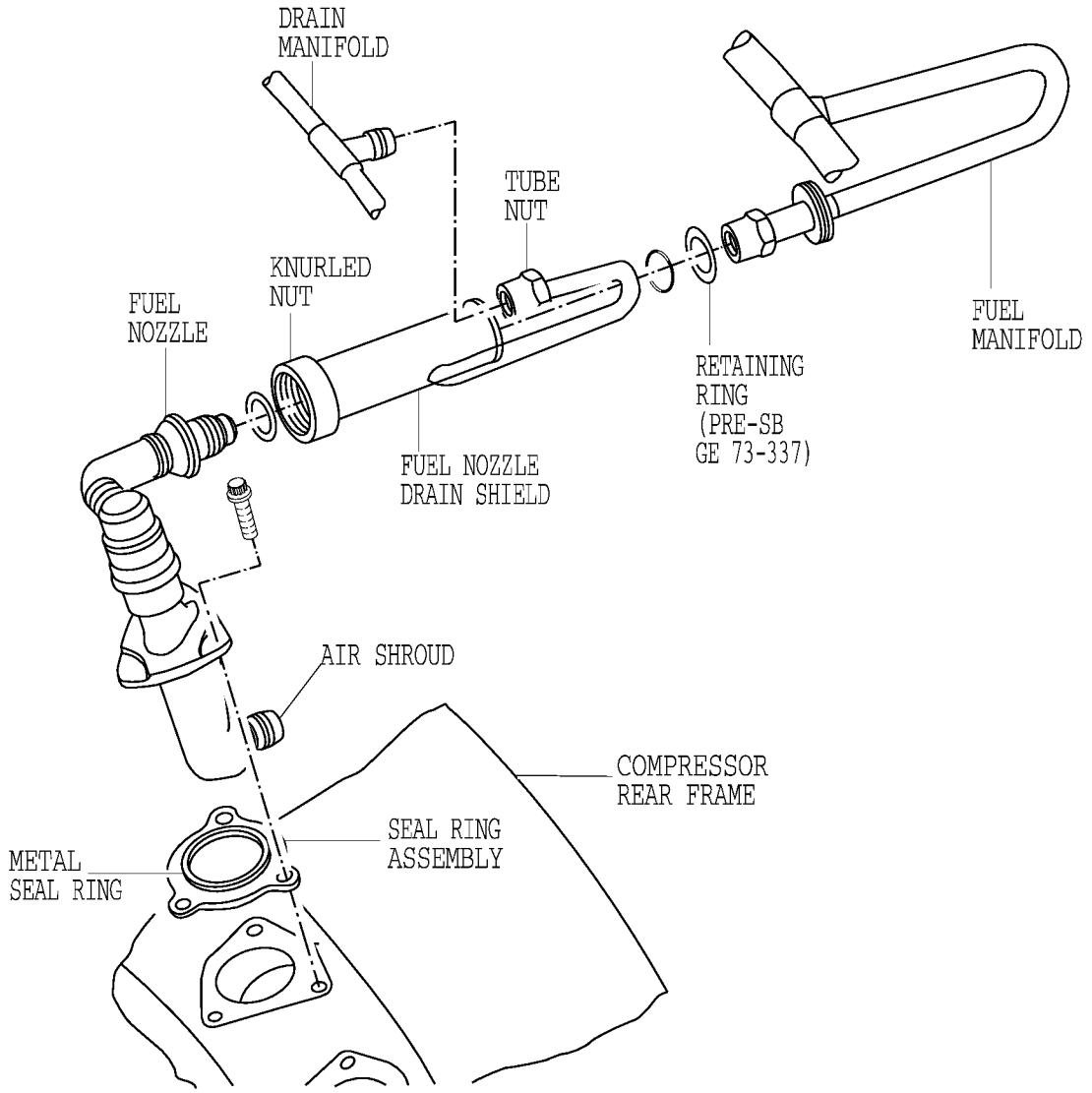
Fuel Manifold Installation (Post SB GE 73-337)
(Sheet 8/9)
Figure 407



1236684-00-A

BM5 731303 4 LKMJ 00

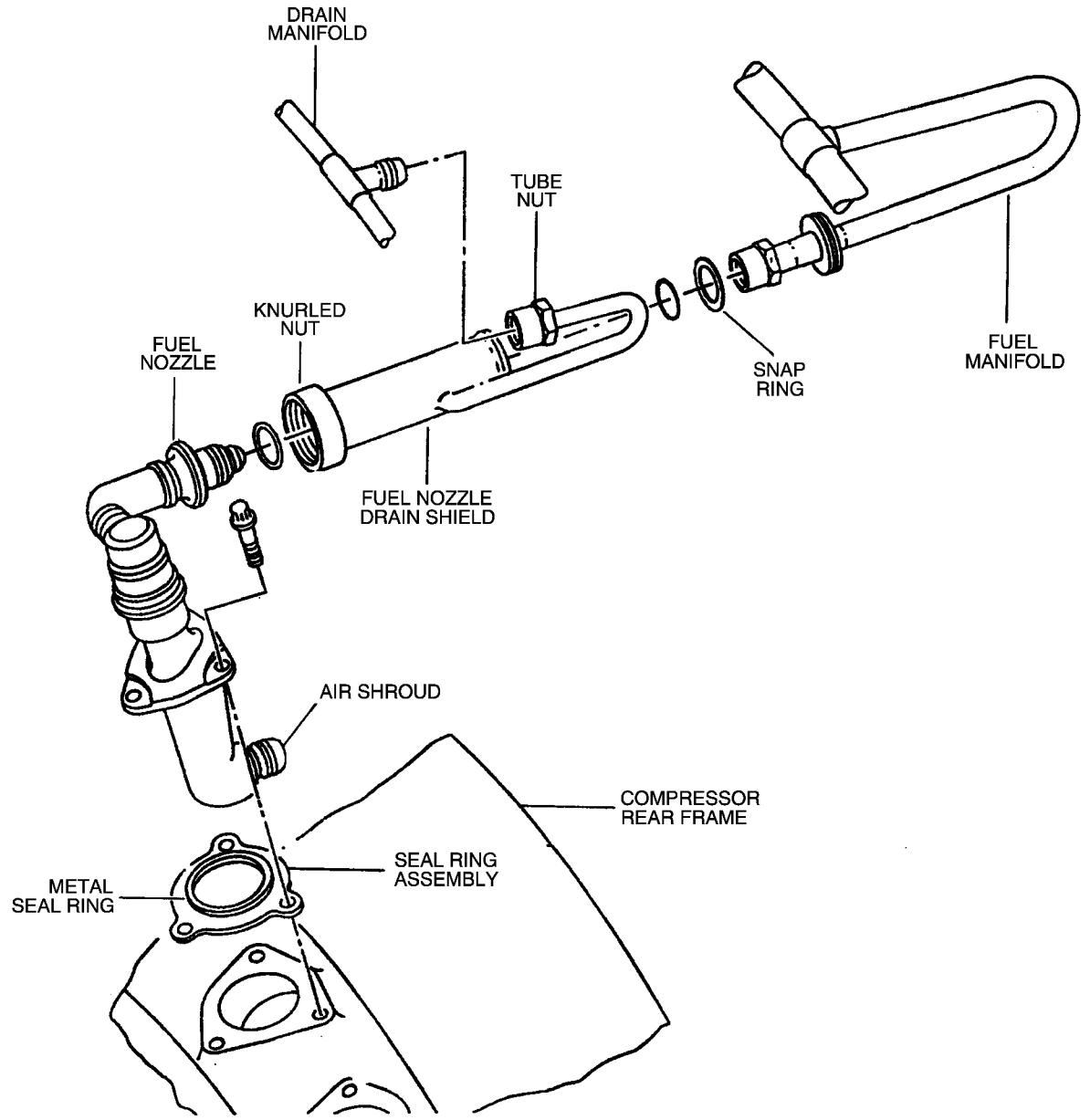
Fuel Manifold Installation (Post SB GE 73-337)
(Sheet 9/9)
Figure 407



BM5 73 13 03 4 LGMA 01

Fuel Manifold - Fuel Nozzle Assembly (Pre SB GE 73-253 and Pre SB GE 73-337) (Sheet 1/3)
Figure 408

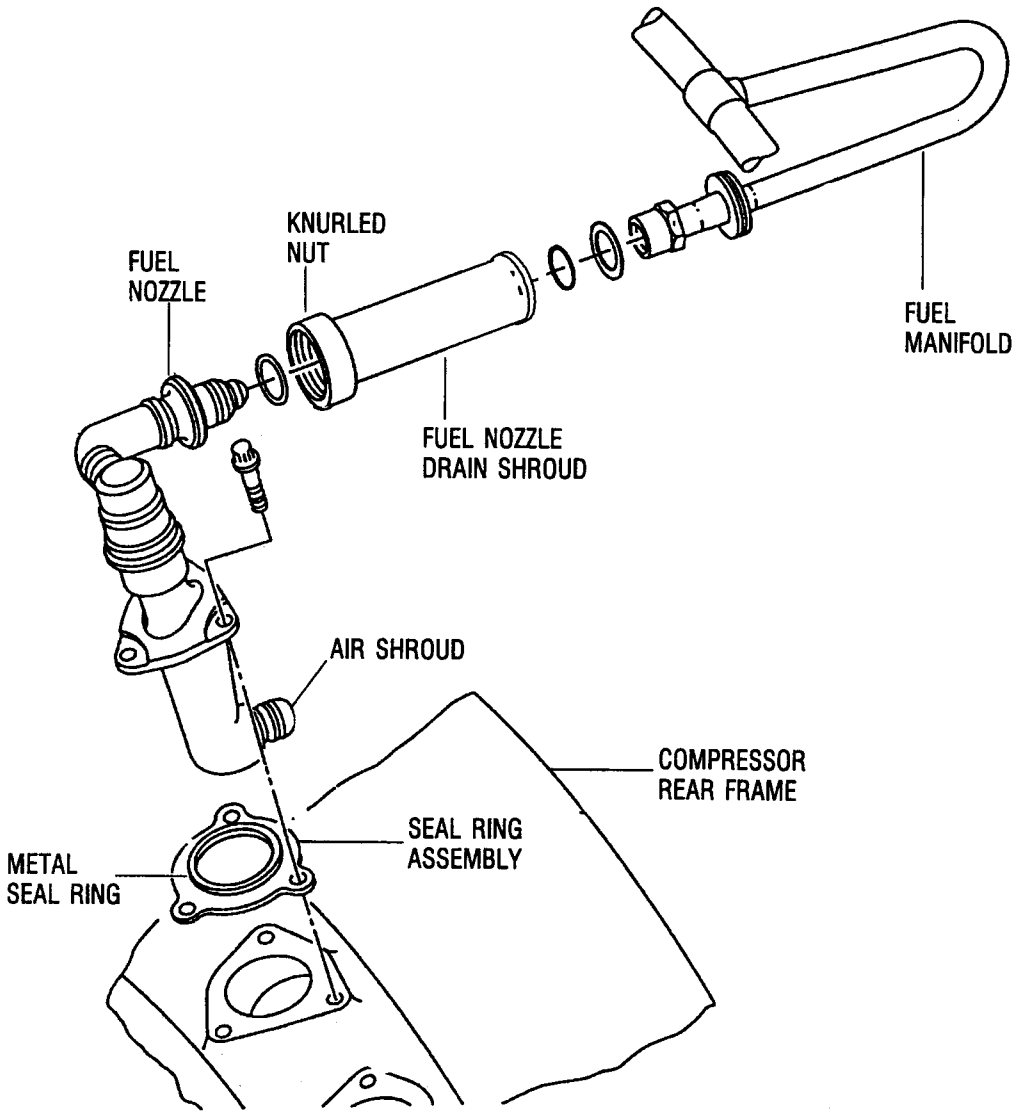
R



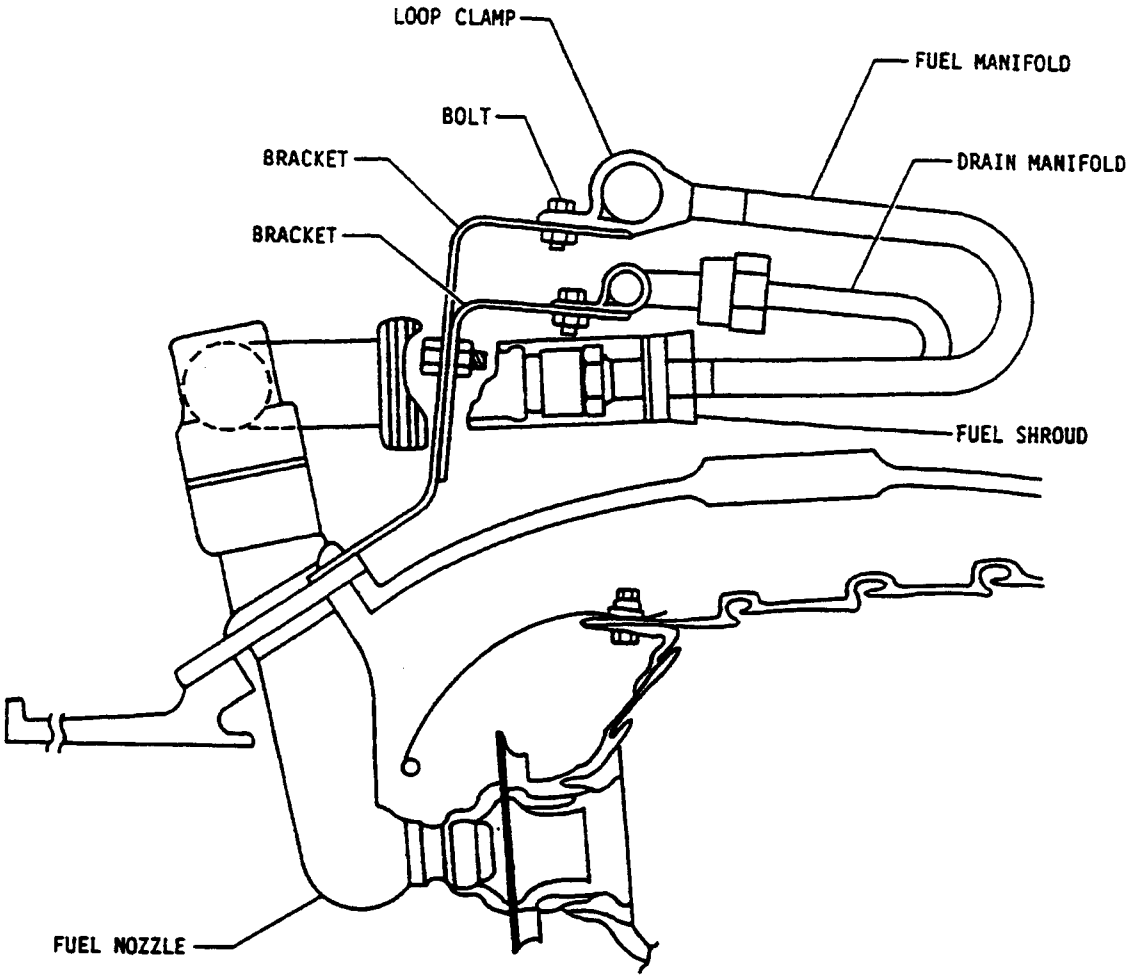
BM5 73 13 03 4 LGMC 00

1151807-00-A

Fuel Manifold - Fuel Nozzle Assembly (Pre SB GE 73-253 and Post SB GE 73-337) (Sheet 2/3)
Figure 408

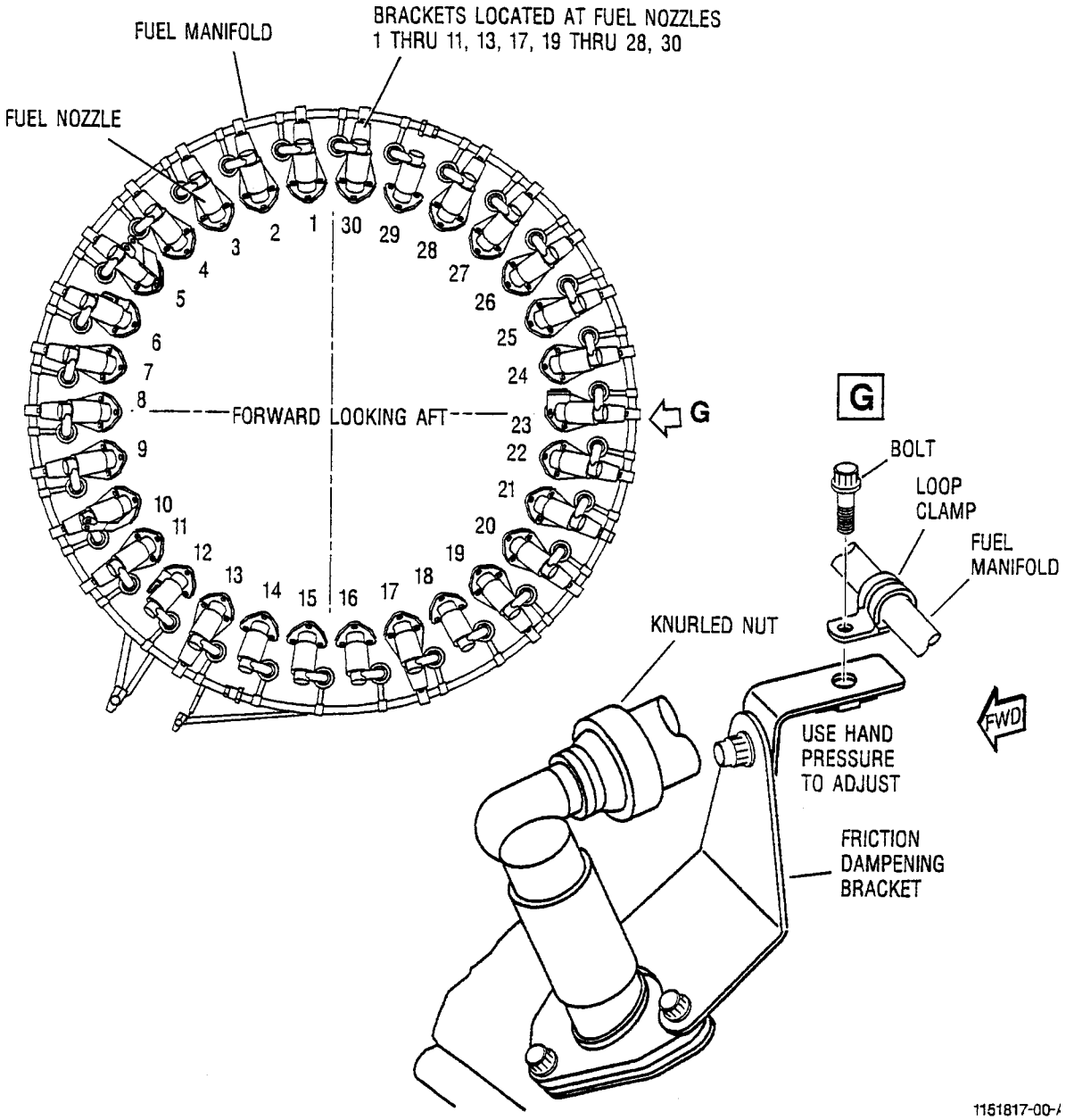


Fuel Manifold - Fuel Nozzle Assembly
(Post SB GE 73-253) (Sheet 3/3)
Figure 408



BM5 73 13 03 4 LHMA 00

Fuel Manifold Bracket Support System (Pre SB GE 73-253 and Pre SB GE 73-170) (Sheet 1/2)
Figure 409



BM5 73 13 03 4 LHMJ 00

Fuel Manifold Bracket Support System
(Post SB GE 73-253) (Sheet 2/2)
Figure 409

FUEL SUPPLY MANIFOLDS - INSPECTION/CHECK

1. General

This procedure provides instructions for the inspection of the fuel manifold from the fuel pump to the fuel nozzles.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
R C. Material No.C04-035	Cleaning Compounds and Solvents
R	(Ref. 70-00-00)
R D. Material No.C10-230	Miscellaneous (Ref. 70-00-00)
R Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
R - 73-13-03, P. Block 401	Fuel Supply Manifolds

3. Procedure

Pre SB GE 73-253

R (Ref. Fig. 601, 603, 605)

R (Ref. Fig. 606)

End Pre SB GE 73-253

Post SB GE 73-253

R (Ref. Fig. 602, 604, 605)

R (Ref. Fig. 606)

End Post SB GE 73-253

A. Job Set-Up

(1)Open, safety and tag the appropriate circuit breakers and open cowl doors (Ref. 71-13-00, P. Block 301).

(2)Install access platform.

R B. Visual Inspection of the Fuel Manifolds at Location of Loop Clamps

R Pre SB GE 73-253

R (1)Remove and discard all loop clamps, that hold the fuel manifold to the compressor rear frame (CRF) friction dampening brackets.

R NOTE : It is not necessary to remove and discard loop clamps on the fuel drain manifold locations.

R (2)Visually inspect the full circumference of the fuel manifold for wear at each clamp location.

R (a)When the fuel manifold shows any signs of wear, determine the depth of the wear as follows or with an equivalent method that can detect reduced wall thickness :

R 1 Measure the outside diameter of the tube adjacent to the worn area.

R 2 Measure the worn area at the smallest diameter.

R 3 Subtract the measurement of the worn tube diameter from the unworn diameter measurement. Permitted wear is less than or equal to 0.0035 in. (0.089 mm).

R 4 Replace fuel manifolds with wear greater than 0.0035 in. (0.089 mm)

but less or equal to 0.010 in. (0.25 mm), within 50 flight cycles.
5 Replace fuel manifolds with wear greater than 0.010 in. (0.25 mm) before further flight (Ref. 73-13-03, P. Block 401).
(b)Replace the discarded loop clamps with new, zero-time clamps.
End Pre SB GE 73-253
Post SB GE 73-253
Pre SB GE 73-365
(1)Remove and discard all loop clamps, that hold the fuel manifold to the compressor rear frame (CRF) friction dampening brackets.
(2)Visually inspect the full circumference of the fuel manifold for wear at each clamp location.
(a)When the fuel manifold shows any signs of wear, determine the depth of the wear as follows or with an equivalent method that can detect reduced wall thickness :
1 Measure the outside diameter of the tube adjacent to the worn area.
2 Measure the worn area at the smallest diameter.
3 Subtract the measurement of the worn tube diameter from the unworn diameter measurement. Permitted wear is less than or equal to 0.0035 in. (0.089 mm).
4 Replace fuel manifolds with wear greater than 0.0035 in. (0.089 mm) but less or equal to 0.010 in. (0.25 mm), within 50 flight cycles.
5 Replace fuel manifolds with wear greater than 0.010 in. (0.25 mm) before further flight (Ref. 73-13-03, P. Block 401).
(b)Replace the discarded loop clamps with new, zero-time clamps.
End Pre SB GE 73-365
Post SB GE 73-365
(1)Remove and discard all loop clamps, that hold the fuel manifold to the compressor rear frame (CRF) friction dampening brackets.
(2)Examine Silicone Adhesive PTFE Film Tape (Material No.C10-230) applied on the fuel manifold :
WARNING : ISOPROPYL ALCOHOL (MATERIAL No.C04-035) IS TOXIC AND FLAMMABLE. USE PERSONAL PROTECTION EQUIPMENT. USE IN A WELL-VENTILATED AREA.
NOTE : Isopropyl alcohol (Material No.C04-035) can be used to help in tape removal. Allow time to dry. If tape or contamination remains after cleaning, clean once again.
NOTE : If tape removal was required, clean the fuel manifold at loop clamp places (Ref. 70-00-00, P. Block 201).
NOTE : Damage condition is defined as wrinkles, tears or evidence of wear. It does not include compression or burnishing.

CONDITION	MAXIMUM SERVICEABLE LIMITS	REMARKS
(a)PTFE tape (Material No.C10-230) has no visual evidence of unbonded areas between the	Permitted	Install new, zero-time loop clamp (Ref. 73-13-03, P. Block 401). Make sure tape extends beyond edge of the loop

CONDITION	MAXIMUM SERVICEABLE LIMITS	REMARKS
tape and the manifold, no damage detected by unmagnified visual inspection and no loose tape material.		clamp.
(b)PTFE tape (Material No.C10-230) has visual evidence of unbonded areas between the tape and the manifold, or has damage detected by unmagnified visual inspection or loose tape material but has no parent metal exposed through the tape.	Not permitted	Remove tape. Apply new PTFE tape (Material No.C10-230) and install new, zero-time loop clamp (Ref. 73-13-03, P. Block 401). Make sure tape extends beyond edge of the loop clamp.
(c)PTFE tape (Material No.C10-230) wears through to parent metal of the tube.	Not permitted	Remove tape and inspect fuel manifold. Apply the new PTFE tape (Material No.C10-230) and install new, zero-time loop clamp (Ref. 73-13-03, P. Block 401). Make sure tape extends beyond edge of the loop clamp.

(3)Visually inspect the full circumference of the fuel manifold for wear at each clamp location.

(a)When the fuel manifold shows any signs of wear, determine the depth of the wear as follows or with an equivalent method that can detect reduced wall thickness :

1 Measure the outside diameter of the tube adjacent to the worn area.

2 Measure the worn area at the smallest diameter.

3 Subtract the measurement of the worn tube diameter from the unworn diameter measurement. Permitted wear is less than or equal to

R 0.0035 in. (0.089 mm).
R 4 Replace fuel manifolds with wear greater than 0.0035 in. (0.089 mm) but less or equal to 0.010 in. (0.25 mm), within 50 flight cycles.
R 5 Replace fuel manifolds with wear greater than 0.010 in. (0.25 mm) before further flight (Ref. 73-13-03, P. Block 401).
R (b)Replace the discarded loop clamps with new, zero-time clamps.
R End Post SB GE 73-365
R End Post SB GE 73-253

R C. Visual Inspection/Check
Visually inspect the fuel manifold as follows :

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(1)All areas for cracks or splits	None allowed	Replace
(2)Shroud for :		
(a)Cracks	None allowed	Replace shroud
(b)Wrinkles in bends	Depth shall not exceed 10% of nominal tube diameter	Replace shroud
(c)Dents	No more than one in two in. (50.8 mm) spaced at least 0.25 in. (6.4 mm) edge to edge apart, provided depth of each dent does not exceed 30% of tube OD and radius is not less than 2 times the wall thickness. In addition, dents in shroud shall not touch inner tube.	Replace shroud
(d)Flat areas	Length shall not be greater than 3 times the tube OD, and contour change shall not exceed 20% of the tube OD.	Replace shroud
(e)Nicks, scratches, or gouges in :		
1 Shroud wall	0.010 in. (0.25 mm) deep	Replace shroud
2 Flange seating or	0.005 in. (0.13 mm) max depth	Replace shroud

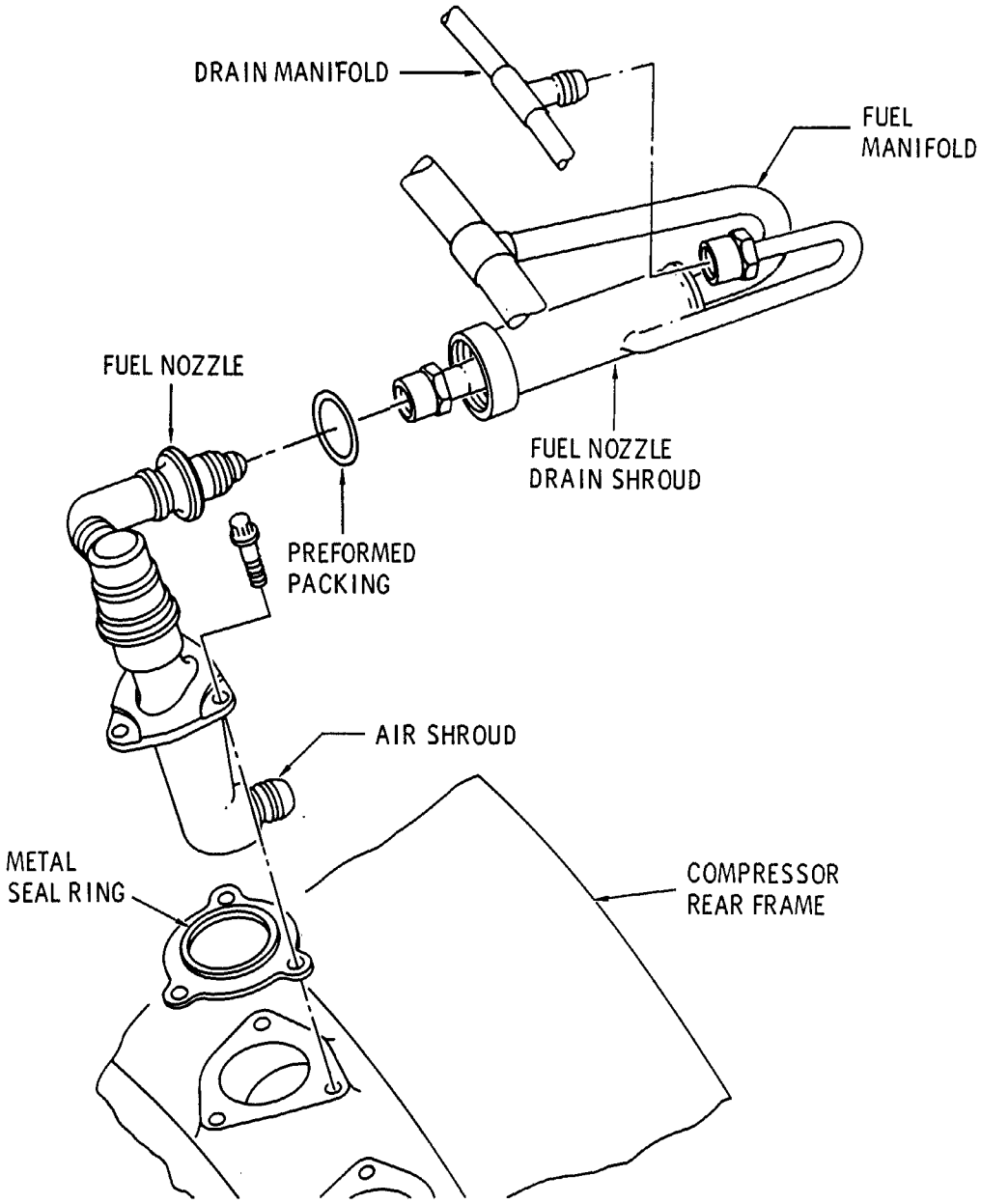
INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
sealing surface		
(f)Thread damage	One half thread cumulative or continuous, may be missing after thread chasing	Chase thread or replace shroud
(g)Gaps at mating surfaces	Any amount provided leak test limits are met	Replace shroud
(3)Fuel tubes for :		
(a)Wrinkles in bend	4% of nominal tube OD	Replace
(b)Dents or flat areas in straight lengths	Not to exceed 15% of nominal tube OD with a min. radius of 0.010 in. (0.25 mm) and no more than 1 dent per in. (25.4 mm) of length	Replace
(c)Nicks, scratches, and cuts in straight lengths	0.005 in. (0.13 mm) max depth	Blend or replace
(4)Fuel tube fitting seating surfaces for :		
(a)Circumferential scratches areas A and C	Any amount to 0.005 in. (0.13 mm) deep after removal of high metal	Blend or replace
(b)Circumferential scratches area B	Any amount not detectable using a 0.040 in. (1.0 mm) radius ball scribe	Blend or replace
(c)Axial scratches, areas A and C	Any amount to 0.005 in. (0.25 mm) deep after removal of high metal	Blend or replace
(d)Axial scratches, area B	Not serviceable	Replace manifold
(e)Nicks and pits, area C	Any amount not exceeding 0.032 in. (0.8 mm) after blending Not serviceable	Replace nut and fitting
(f)Nicks and pits,	Not serviceable	Replace manifold

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
areas A and B		
(g)Circumferential score marks on silver plated seating (mating) surfaces	Any amount, provided score mark does not penetrate parent metal	Replace manifold
(h)Circumferential deformation (spreading) of :		
1 Tube/ferrule	Any amount, provided nut rotates freely	Replace nut
2 Flare nut	Any amount provided nut rotates freely	Replace nut
R (j)Axial deformation (dishing) of spherical seat fitting surface	Any amount, provided depth is uniform and less than 0.005 in. (0.13 mm) normal to surface	Replace manifold
(5)Tube and hose fitting nuts for :		
(a)Damaged corners	Any amount, provided proper torque can be obtained	Replace nut and fitting
(b)Damaged thread	Any amount, provided effective threads are not reduced by more than one after chasing	Replace nut and fitting
(c)Damaged lock-wire holes	Hole deformation and wear acceptable, provided metal around holes is not cracked or torn	Blend out damage and drill new hole
(6)Tube/Hose assembly for : NOTE : A slight flatting in the bend of a Teflon-Lined hose assembly, caused by permanent set and not associated with a buckle or crimp, is acceptable.		
(a)Hose leakage	Not serviceable	Replace assembly
(7)Hose assemblies for :		
(a)Broken hose braid	Three broken wires per lay, and no more than six broken	Replace hose

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
	wires per assembly or per lineal foot (305 mm) of hose	
(b)Crimps	Not serviceable	Replace hose
(c)Internal obstructions	Not serviceable	Remove obstruction or replace hose
(d)Cuts, tears chafing or hose	Not serviceable	Replace hose
(8)Saddle Fittings for :		
(a)Separation and cracks	Not serviceable	Replace manifold

R

C. Close-Up
(1)Remove access platform.
(2)Close cowl doors, remove safety clips and tags and close circuit breakers (Ref. 71-13-00, P. Block 301).



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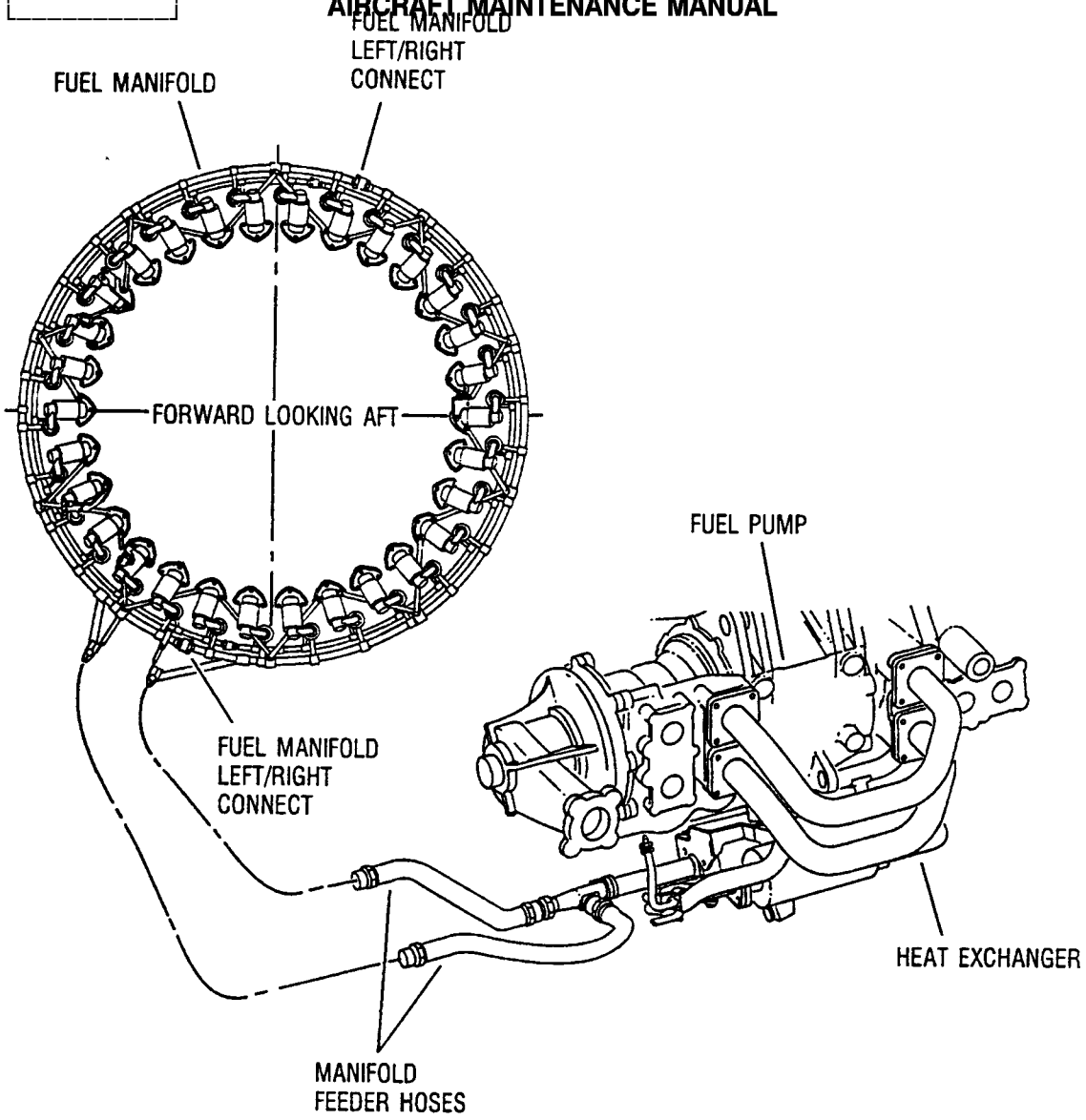
Fuel Manifold Drain Shroud (Pre SB GE 73-253) (Sheet 1/2)
Figure 601



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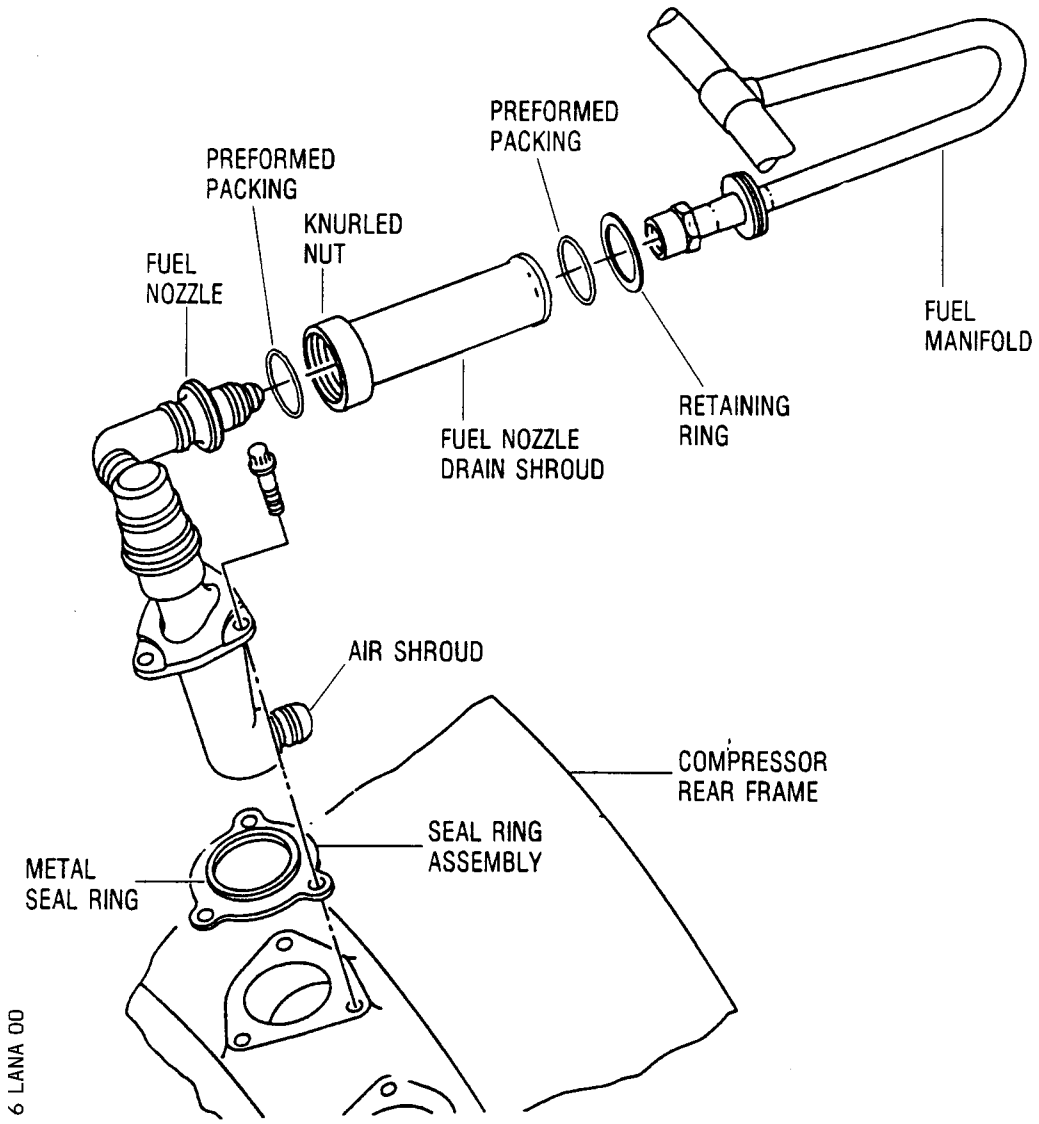
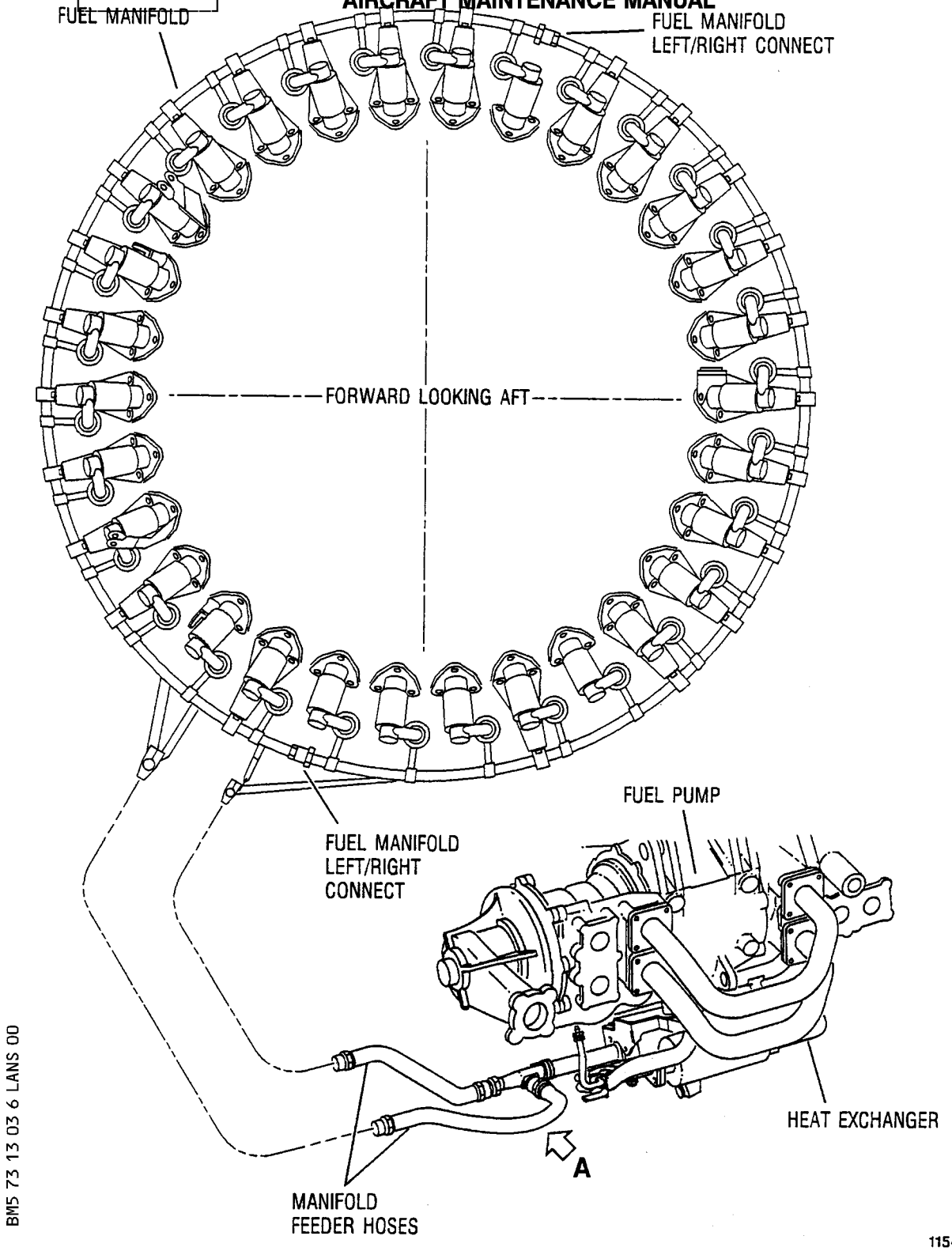
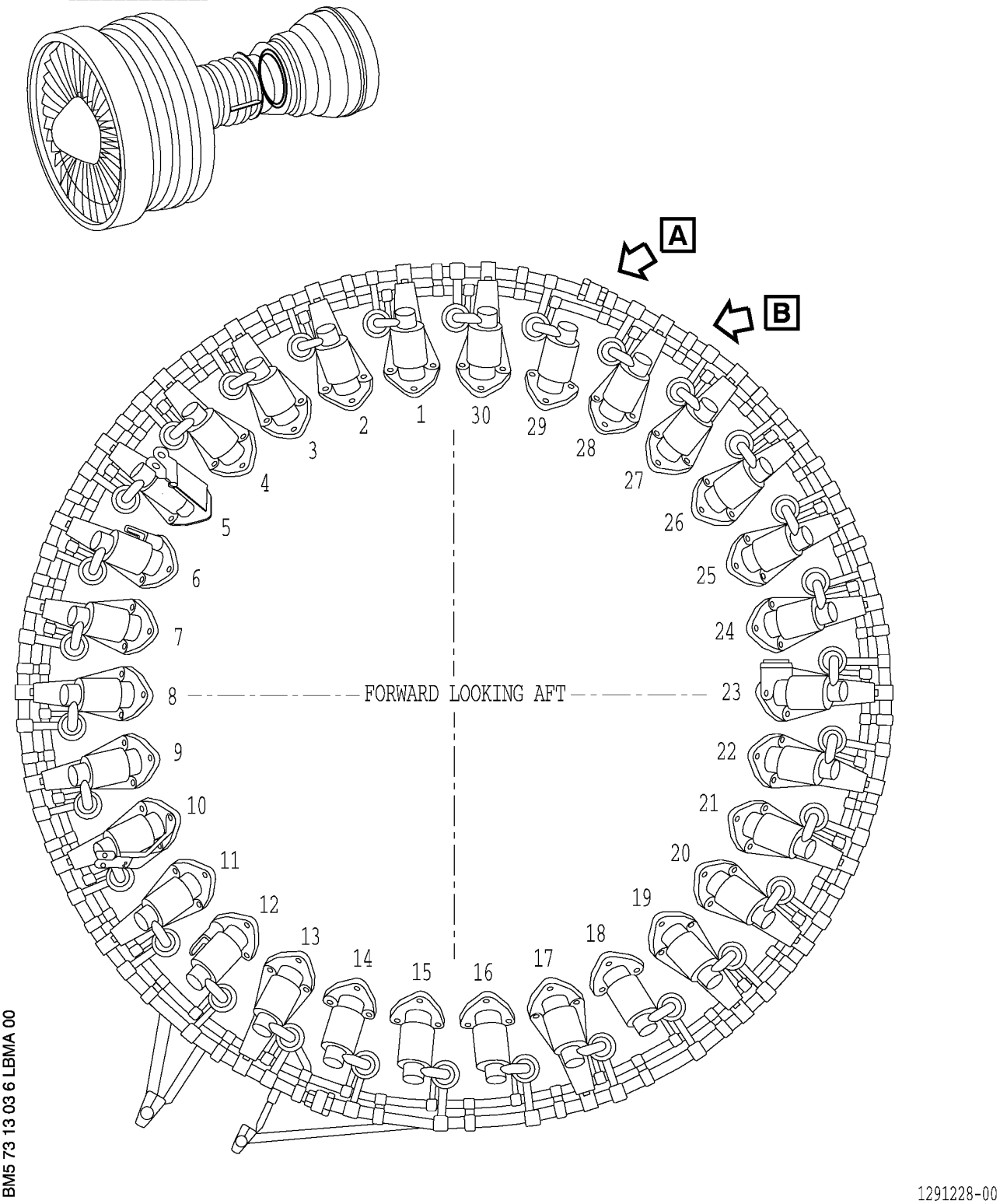
Fuel Manifold Drain Shroud (Pre SB GE 73-253) (Sheet 2/2)
Figure 601



Fuel Manifold Drain Shroud (Post SB GE 73-253) (Sheet 1/2)
Figure 602

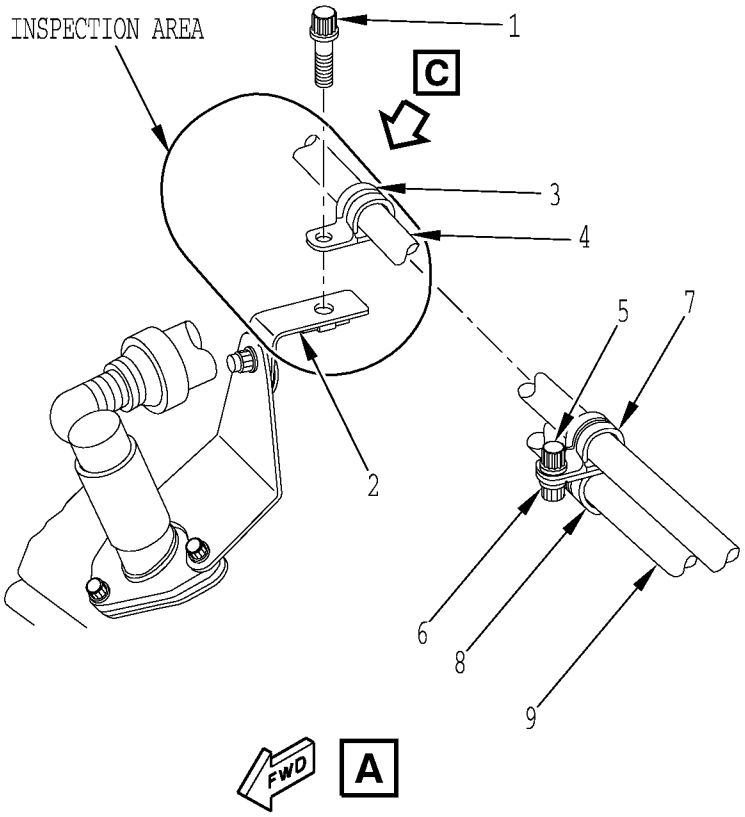


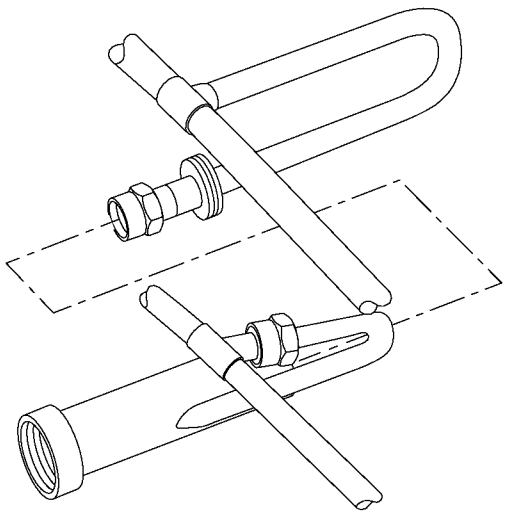
Fuel Manifold Drain Shroud (Post SB GE 73-253) (Sheet 2/2)
Figure 602



Drained Fuel Manifold (Sheet 1/3) (Pre SB GE 73-253)
Figure 603

R





LEGEND:

1. CUSHIONED LOOP CLAMP BOLT
2. FRICTION DAMPER BRACKET
3. CUSHIONED LOOP CLAMP
4. FUEL MANIFOLD
5. CUSHIONED LOOP CLAMP BOLT
6. NUT
7. CUSHIONED LOOP CLAMP
8. CUSHIONED LOOP CLAMP
9. FUEL DRAIN MANIFOLD

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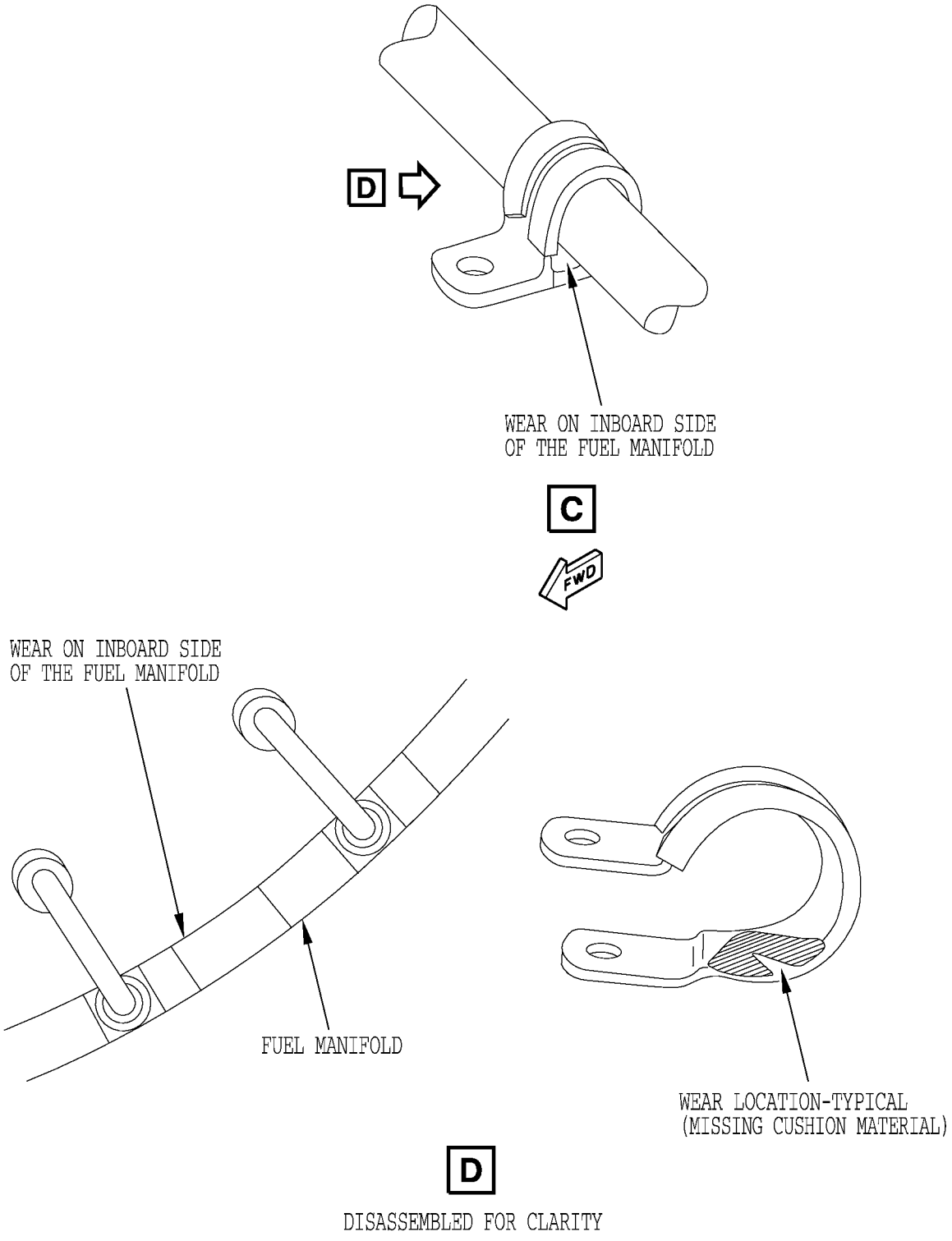
Drained Fuel Manifold (Sheet 2/3) (Pre SB GE 73-253)
Figure 603

R



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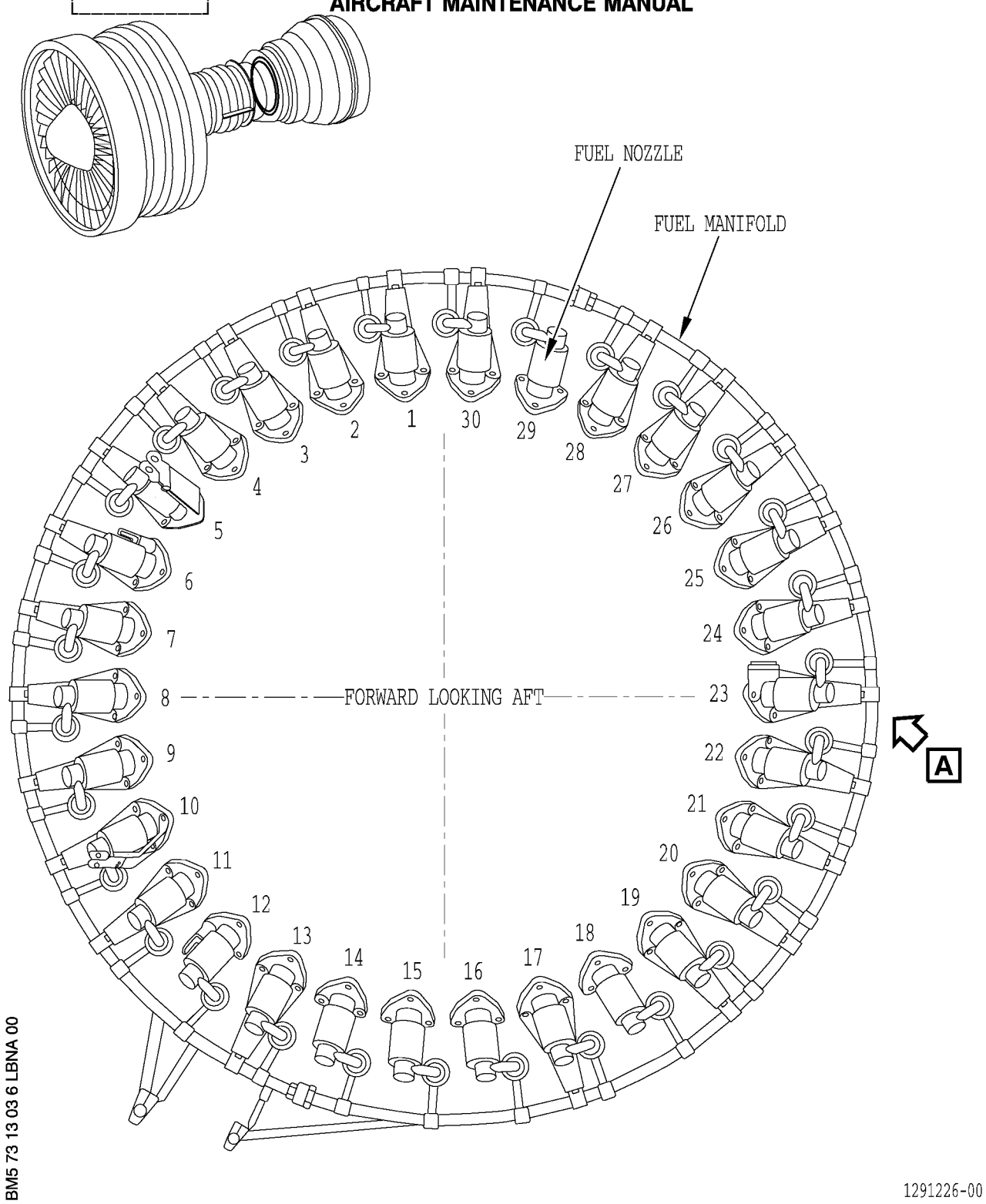
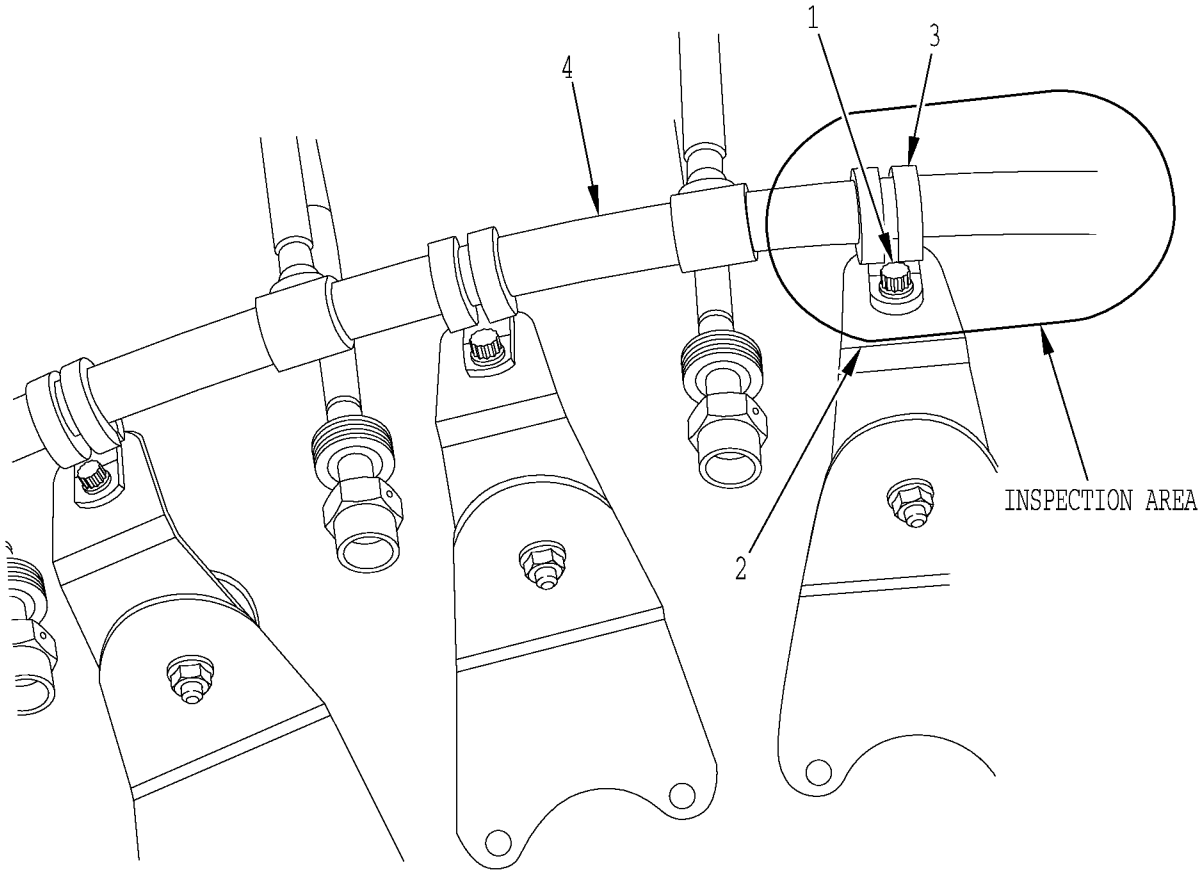
Drained Fuel Manifold (Sheet 3/3) (Pre SB GE 73-253)
Figure 603

R



Drainless Fuel Manifold (Sheet 1/2) (Post SB GE 73-253)
Figure 604

R



A

LEGEND:

1. CUSHIONED LOOP CLAMP BOLT
2. FRICTION DAMPER BRACKET
3. CUSHIONED LOOP CLAMP
4. FUEL MANIFOLD

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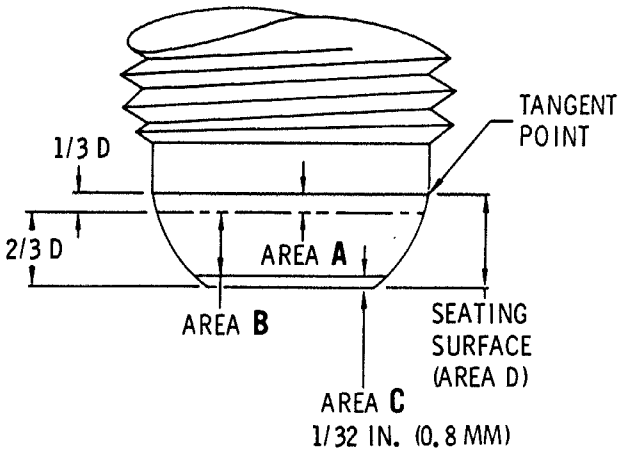
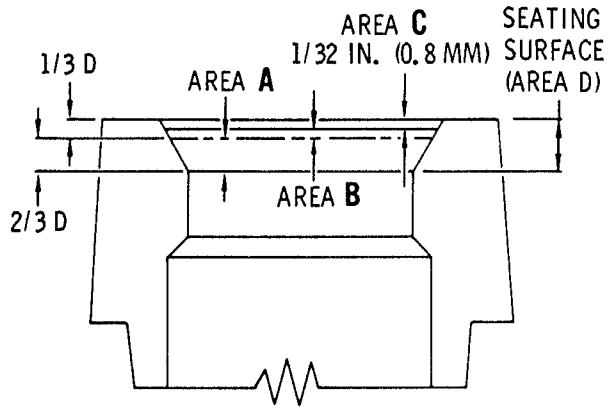
BM5 73 13 03 6 LBNS 00

Drainless Fuel Manifold (Sheet 2/2) (Post SB GE 73-253)

R Figure 604



TUBE/HOSE FERRULE



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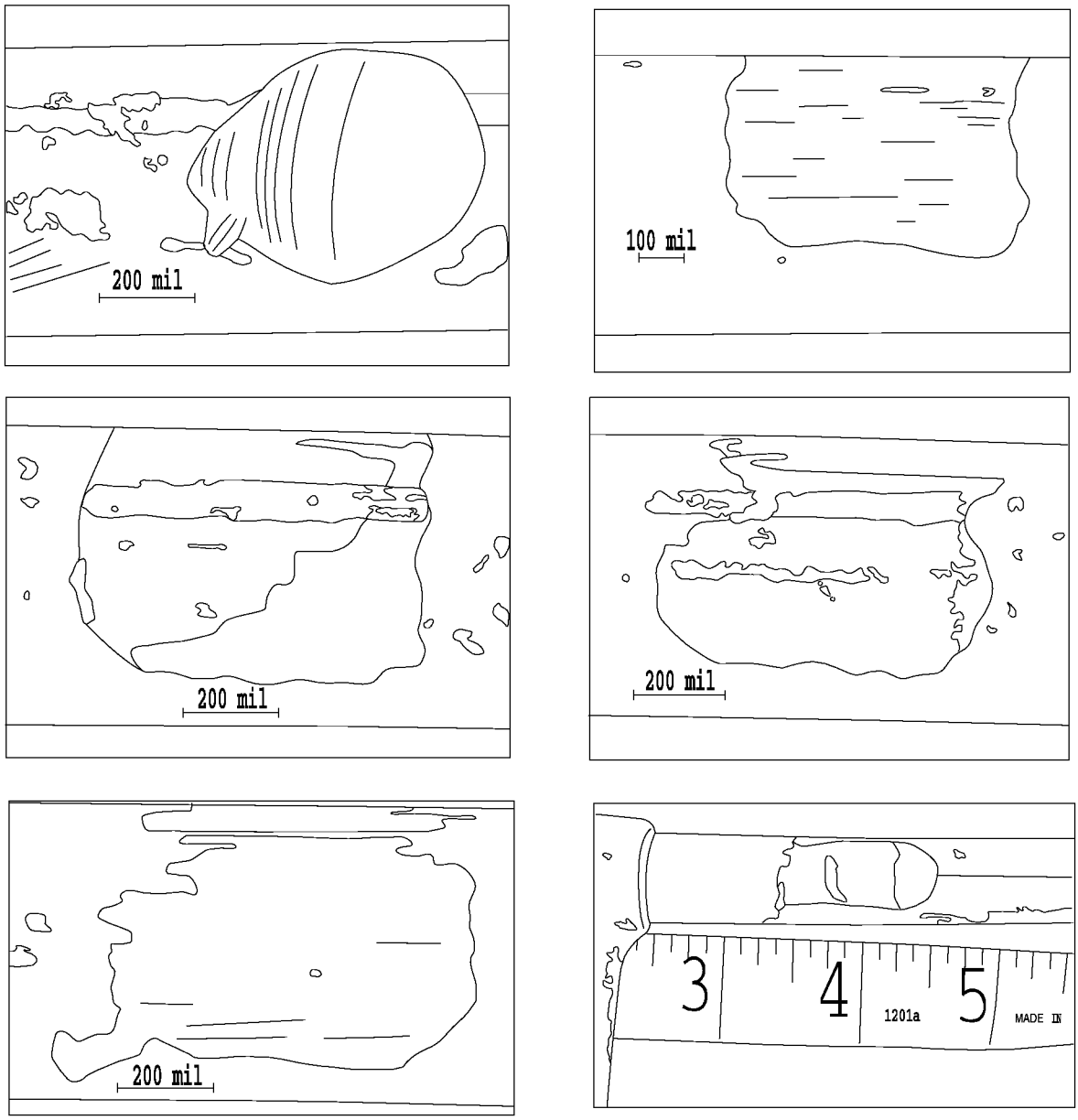
R

Tube and Hose Fitting Seating Surfaces
Figure 605



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NOTE:
THESE PHOTOS ARE EXAMPLES OF CLAMP WEAR ON THE TUBE AND SHOULD BE MEASURED TO DETERMINE WALL THINNING.

1291231-00

R Inspection of Fuel Manifold
Figure 606

COMBUSTOR DRAIN VALVE - REMOVAL/INSTALLATION

1. General

The combustor drain valve is located at the 5:30 o'clock position aft of the accessory gearbox compartment on the low-pressure turbine cooling air manifold. Access to drain valve is gained by opening the right hand core cowl.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Protective Covers
C.	Torque Wrench 24-300 lbf.in. (0.27-3.39 m.daN)
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors

3. Procedure

A. Job Set-Up

(1) Open, safety and tag the circuit breakers for the appropriate engine and open fan thrust reverser and core cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401)

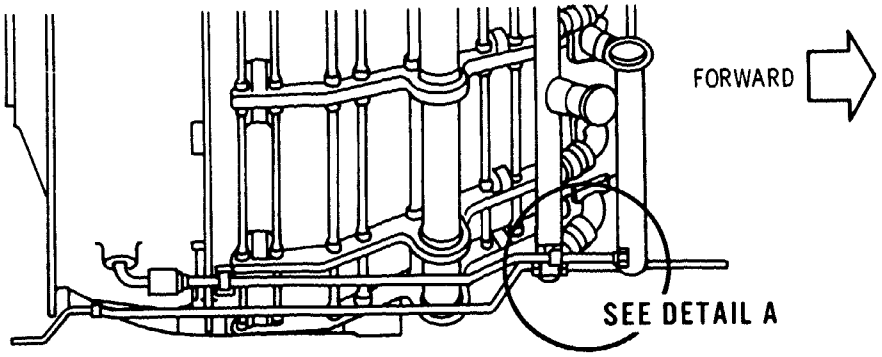
(1) Remove bolt, washer, nut and clamp from support bracket.
(2) Disconnect inlet and outlet tubes from the valve.
(3) Install protective covers on tube ends and open ports of the valve.

C. Installation (Ref. Fig. 401)

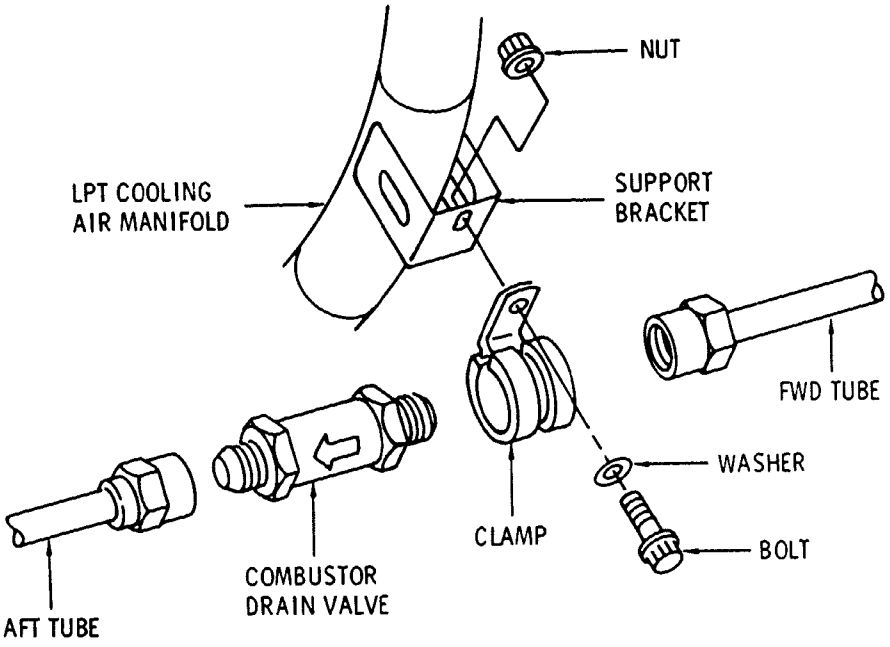
(1) Remove protective covers from tubes and ports of valve.
(2) Connect forward tube to inlet port of valve (end toward arrow). TORQUE B-nut to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).
(3) Connect aft tube to outlet port of valve (end opposite arrow). TORQUE B-nut to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).
(4) Install clamp onto mounting bracket using bolt, washer and nut. TORQUE nut to between 24 and 27 lbf.in. (0.27 and 0.31 m.daN).

D. Close-Up and Test

(1) Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2) Close core, thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).
(3) Remove safety clips and tags and close circuit breakers 1KG, 1JH, 2JH, 1KM and 2KM.
(4) Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501).



DETAIL A



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Combustor Drain Valve - Removal/Installation
Figure 401

COMBUSTOR DRAIN VALVE - INSPECTION/CHECK

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Shop Air Supply or Nitrogen 0 to 25 psi (0 to 1.72 bars).
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up
(1)Open, safety and tag the appropriate circuit breakers and open core cowl doors (Ref. 71-13-00, P. Block 301).

B. Visual Inspection.
(1)Visually inspect the following

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(a)Fitting Ends for :		
1 Nicks, dents and axial scoring on sealing surfaces	Not serviceable	Replace valve
2 Thread damage	Up to 50 percent of one thread or 10 percent of 2 threads after removal of high metal	Replace valve

C. Valve Actuation Check
(1)Connect shop air supply or dry nitrogen to inlet of valve with outlet remaining open.
(2)Apply pressure. Valve must close at 19 psig (1.31 bars) or less.
(3)Reduce pressure. Valve must open at 11 psig (0.76 bars) or less.

D. Close-Up
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Close core cowl doors. Remove safety clips and tags and close the appropriate circuit breakers (Ref. 71-13-00, P. Block 301).

1. General (Ref. Fig. 001)
Fuel control is provided by
- the MEC
- the minimum/maximum idle control
- the PMC.

2. Description

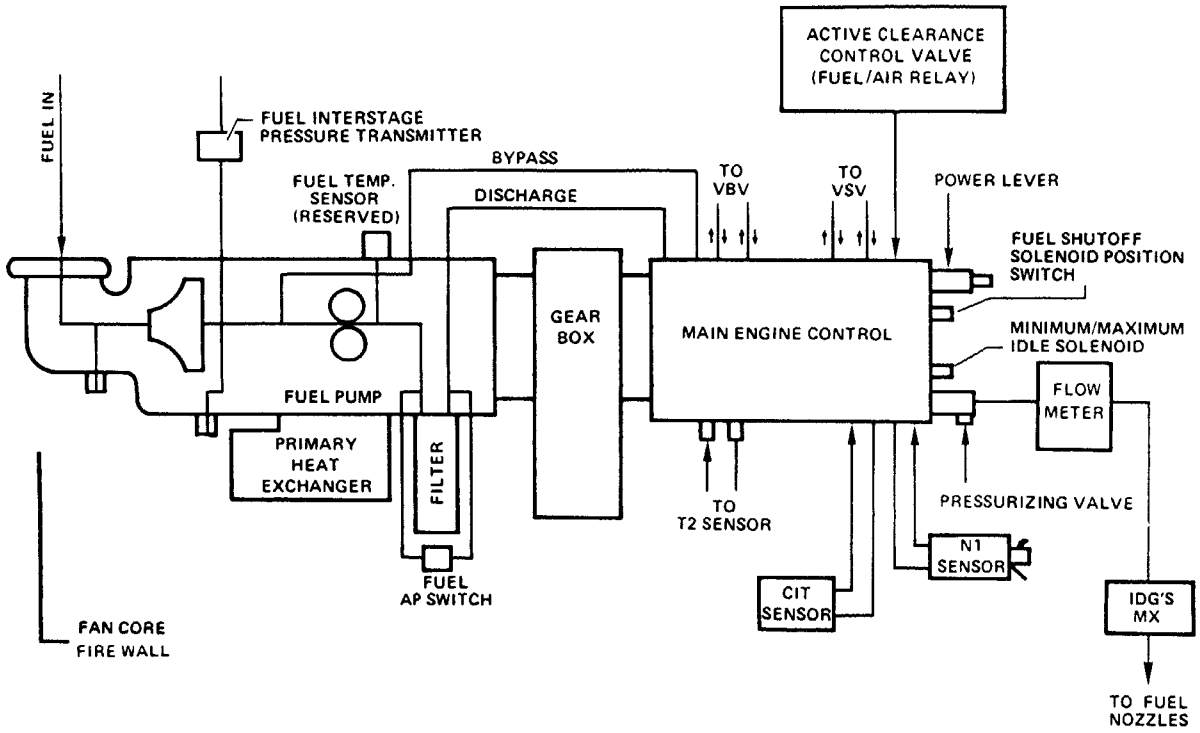
A. Main Engine Control (Ref. Fig. 002)
The MEC is installed on the forward face of the accessory gearbox at the extreme right side pad. The MEC is of the hydromechanical type, the operating fluid is the fuel supplied by the fuel pump which reaches the MEC after being filtered. The MEC function is to control the fuel flow to the engine ; thus to regulate the N1 or N2 speeds and to ensure a proper operation of the engine.
After generating a certain number of reference pressures applied to the various distributor valves, the MEC utilizes the following parameters :
- ambient pressure (P0)
- ambient temperature T2
- compressor bleed pressure (CBP) *
- compressor discharge pressure (CDP)
- power levers position (PLA)
- HP compressor speed (N2)
- VSV and VBV position feedback signal
- trim signal from the PMC
- fan speed (N1)
- compressor inlet temperature (CIT).

These parameters are used to supply the thirty fuel nozzles with a fuel flow corresponding to the throttle control levers position and compatible with the engine operating limits (engine stall) on acceleration/ deceleration to position the HP compressor VSV's and VBV's.

(1)MEC Main Functions (Ref. Fig. 004)
(Ref. Fig. 003)

(a)Fuel Scheduling
Fuel metering is accomplished by means of a variable fuel metering port. The opening of the fuel metering port is determined by the computing section of the control (Ref. paragraphs 2.A.(1)(b), (c) and (d). Fuel is directed to the control fuel inlet at pump pressure and in a volume greater than is needed for any condition of engine operation. excess fuel is returned to the pump inlet by means of the fuel bypas valve (Ref. 73-13). Fuel discharge pressure is maintained to a correct value by means of a differential pilot valve which senses on one hand the pressure upstream and downstream of the fuel metering port, on the other hand the bypass and pressurizing valves openings. This valve allows, depending on these parameters, the opening and/or closing of the bypass valve and pressurizing valve. The fuel metering port opening is is limited by adjustable, positive, minimum and maximum mechanical stops.

(b)Fan Speed Scheduling



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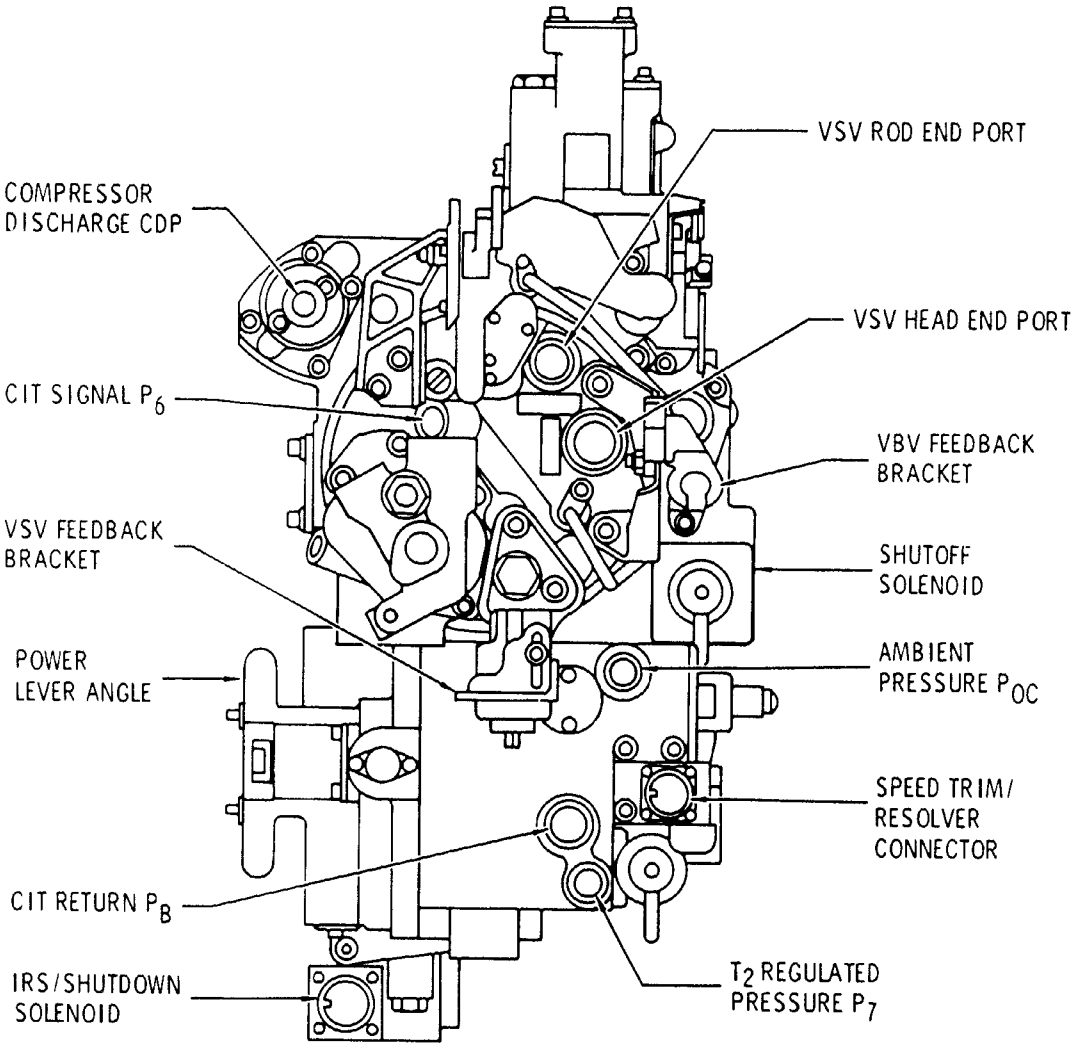
Fuel Control Inputs - Schematic
Figure 001



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Main Engine Control Inputs
Figure 002

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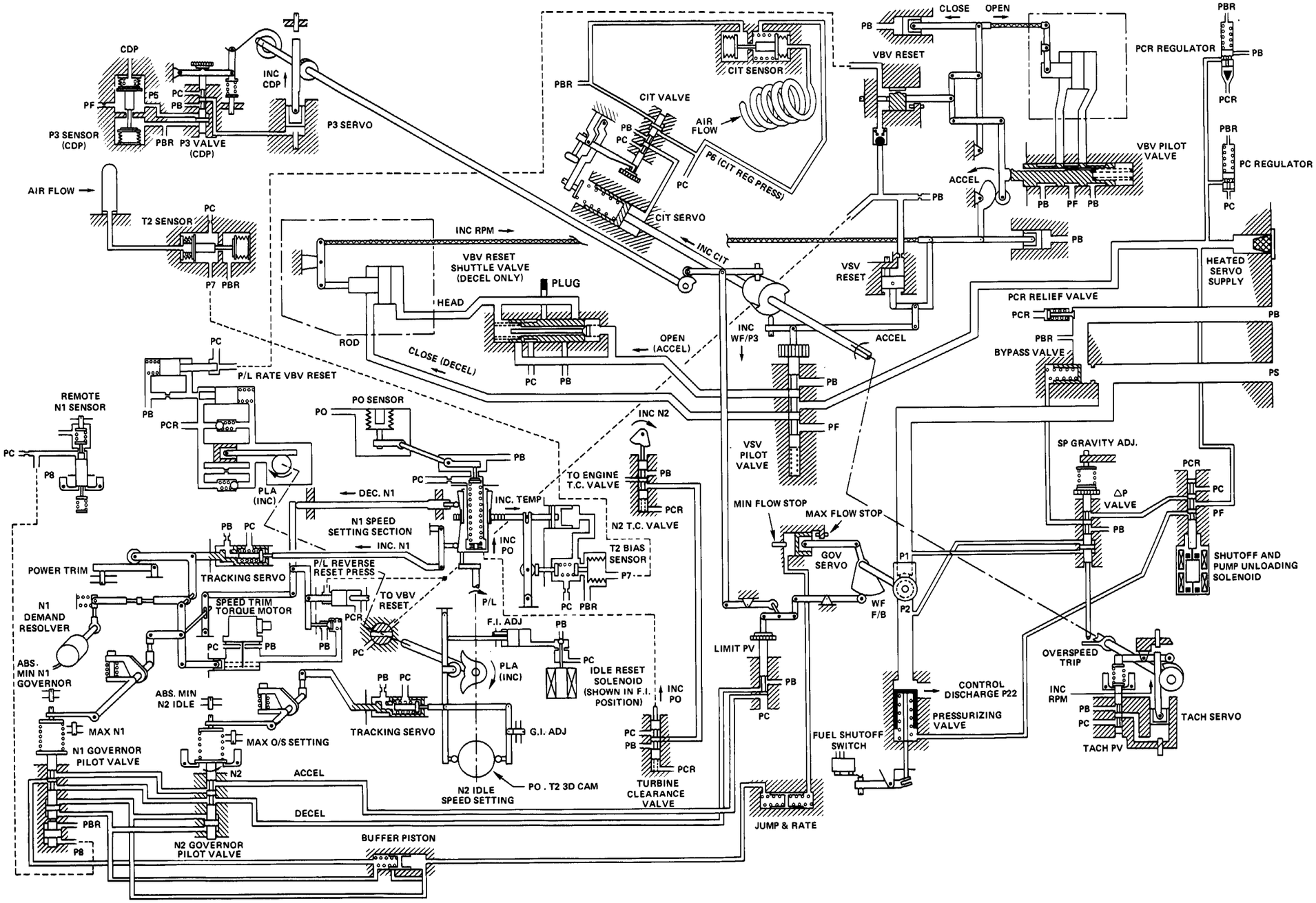

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DM5

Fuel Control Block Diagram
Figure 003

Speed governing is attained through the N1 and N2 governors. N1 governor receives the N1 actual speed from the N1 sensor (Ref. paragraph 4). The power lever applies a torque to a 3D cam which performs a N1 speed schedule function of PLA and Po limited by a maximum N1 speed limiting schedule function of T2 and Po. Output of this 3D cam applies force to the N1 governor speeder spring. When the pressure from the N1 sensor balances the speeder spring force, the engine is in an on-speed condition. If the engine is not on speed, the governor will direct pressure to or from the governor servo piston to change the opening of the fuel metering piston. The adjustment of the speeder spring by the power lever is modified by inputs from the speed trim torque motor (Ref. paragraph 2.A.(1)(h)). Output of the governor is modified by the N2 speed (Ref. paragraph 2.A.(1)(c)) and by the acceleration/deceleration 3D cam (Ref. paragraph 2.A.(1)(d)). A max. speed stop prevents the N1 governor demand speed from exceeding 118 ± 0.4% N1.

(c) Core Engine Speed Scheduling

N2 speed sensing is accomplished by means of a tachometer which is a flyweight operated unit driven by the engine. The tachometer senses engine speed N2 and rotates a 3D cam which performs a core idle speed schedule function of Po and T2. Output of this 3D cam applies force through a system of levers to the N2 governor speeder spring. The system of levers operates to schedule the higher of core idle speed schedule and a N2 schedule function of PLA. Core engine idle speed schedule is attained through 2 different levers following the 3D cam, selection of which is controlled by the flight/ground idle solenoid (Ref. 73-22). The N2 governor speeder spring acts against the flyweight centrifugal force, thus directing pressure to or from the N2 governor to the N1 governor and to the fuel metering servo.

Pressure transfer between N1, N2 governors and fuel metering servo is so made that fuel flow is controlled at idle by the N2 governor and above idle by the N1 governor (Ref. Fig. 006).

A max. speed stop prevents the N2 governor demand speed from exceeding 113 ± 0.4% N2.

NOTE : The output of a governor is proportional to the error between the demand speed and the actual speed.

(d) Acceleration/Deceleration Limit

In order to prevent engine stall, overheat, surge or blowout during acceleration, the control comprises an acceleration-limiting 3D cam. It ensures that fuel flow will decrease as engine speed approaches the selected value, thus preventing overspeed and providing for an accurately controlled steady-state condition. The compressor inlet temperature (CIT) is sensed by means of a separate unit mounted on the engine fan frame (Ref. paragraph 3). This hydromechanical unit moves the 3D cam to adjust for inlet air temperature.

The compressor discharge pressure (CDP) is sensed by a bellows-type unit. The effect of CDP is to control hydraulic pressure which, in turn, controls the CDP pilot valve. This valve regulates hydraulic pressure to the CDP servo geared to the CDP camshaft. As the shaft rotates, it turns the CDP cam, thus applying the CDP input to the computer-summing lever. The CDP input is therefore a part of the total effect of all parameters applied to control the position of the 3D cam

and the followers which provide a response.

Another tachometer, also flyweight operated, driven by the engine senses engine speed N2 and rotates the 3D cam by means of a servo geared to the 3D cam-shaft. Fuel metering port opening also rotates a cam (the fuel cam) which modifies motion of the computer-summing lever. Operation of the three cams ; 3D cam, fuel cam and CDP cam provides an integrated effect which is applied to the summing lever to feed a signal force to the limit pilot valve. This valve then controls the hydraulic pressure supply to and the returns from the two governor pilot valves. The governors action are thus limited as a function of the positions of the cams.

(e) Variable Stators Vanes (VSV) and Variable Bypass Vanes (VBV) Control
In order to provide optimum efficiency of the HP compressor, it is necessary to modify the position of vanes located in the six first stages of the stator with respect to the N2K (N2/VCIT/288.15). The VSV'S control is provided via a loop. A feedback cable gives the actual position of the VSV'S which is compared with the desired position. Desired position (viz the correct angle of attack for the air flowing thru the compressor) is attained by the VSV pilot valve which is actuated by a follower on the acceleration-limiting 3D cam.
To match the booster discharge airflow to the core engine requirements at low speed, excess air is bled off through variable bypass valves into the fan discharge airstream. The VBV servo receives an input from the VSV servo reference which is a cam position driven by the VSV feedback, and the VBV position feedback and operates on their difference which is the error. (Ref. 75-31 and 75-32).

(f) For transients, fuel flow is limited by acceleration and deceleration schedules, which are computed as a function of N2, compressor discharge pressure (CDP), compressor bleed pressure (CBP), and compressor inlet temperature T25 (CIT). N2 rpm and CIT signals are combined to form one schedule while the CDP and CBP signals are combined to form another schedule. Increasing N2 and higher CIT will each cause increase in fuel acceleration limit schedules up to the cutback point, (the cutback schedule protects the engine from overtemperature and overspeeds). The increase in CDP will allow fuel flow up to it's cutback point of 460 psia, at which time fuel flow is depressed. At lower speeds, CDP is biased with CBP to provide an accurate input to the acceleration schedule. The acceleration schedules N2/CIT, and CDP/CBP are functioning together to produce the correct fuel/air ratio for engine acceleration.

1 BLEED BIAS (CDP/CBP RATIO) (Ref. Fig. 005)
The bleed bias system provides automatic resetting of the acceleration schedule to maintain rapid acceleration times when customer bleed demand is high, and conversely enables adequate stall margins to be conserved when bleed demand is low. The accel fuel schedule is reduced in the idle region (5000 to 8200 RPM N2K) with no bleed condition. The bleed bias control system provides an acceleration fuel flow schedule which is modulated as a function of customer bleed flow rate.
A combination CDP/CBP sensor is installed to the MEC to receive the output of both the CBP signal from a dual venturi installed in the

upper most 14th stage bleed duct and a CDP (Ps3) signal from the compressor rear frame. When the CBP sensor receives the output of the CBP venturi that 14th stage bleed air is being extracted from the engine it adjusts the CDP signal which will act upon the acceleration fuel schedule to increase fuel flow as bleed increases.
As bleed increases CDP reaches 140 psia, bleed biasing (CDP) is removed.

2 The bleed bias VSV schedule and VBV schedule are modified to increase stall margin at idle and improve high speed performance.

(g)Turbine Clearance Control

The MEC provides an external turbine clearance control fuel signal elaborated by the MEC turbine clearance valve which senses N2 speed and Po. (Ref. 75-23).

(h)Fan Speed Demand Signal

Output of the 3D cam controlling N1 governor (Ref. paragraph 2.A.(1)(b)) is transformed by a resolver in an electrical signal N1 DMD which is sent to the PMC (Ref. 73-23).

(i)Speed Trim

The MEC incorporates an electro hydraulic servo valve capable of modifying N1 governor action in response to a PMC electrical signal (Ref. 73-23). An internal stop limits maximum authority to no more than 18% at 105.5%N1.

(j)Engine Protection and Control

The engine is protected by :
N1 and N2 stops the adjustment of which is made on production
N2 min. = 55 ± 10%
N2 max. = 113 ± 0,40%
N1 max. = 118 ± 0,40%
- An N2 overspeed trip is between 114.2 and 115.2% in the event of any single failure in the control.

The MEC incorporates an inlet pressure unloading valve which provides a bypass circuit to maintain control servo operation and prevent excessive fuel inlet pressure when the fuel shutoff solenoid is actuated to the shut-off mode.

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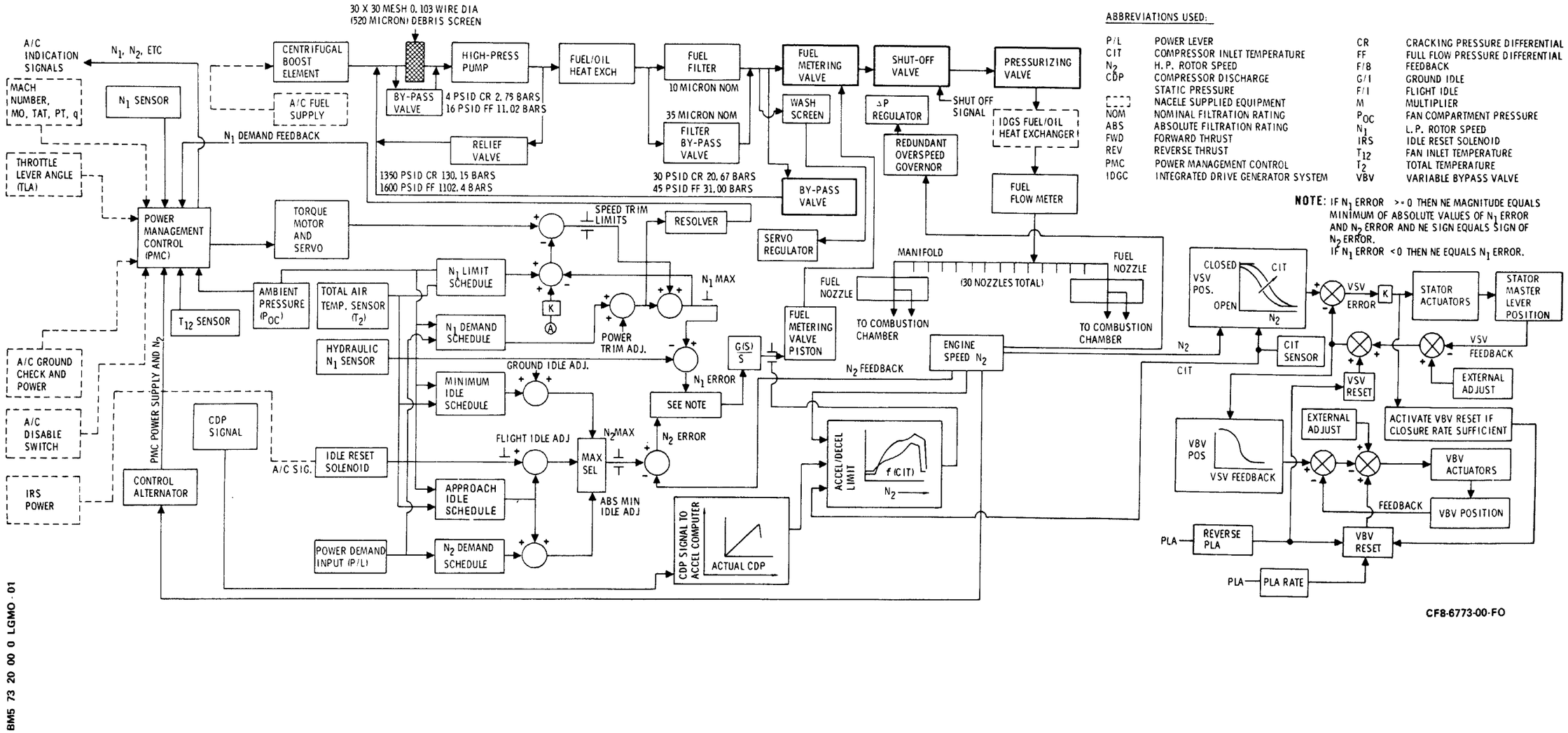

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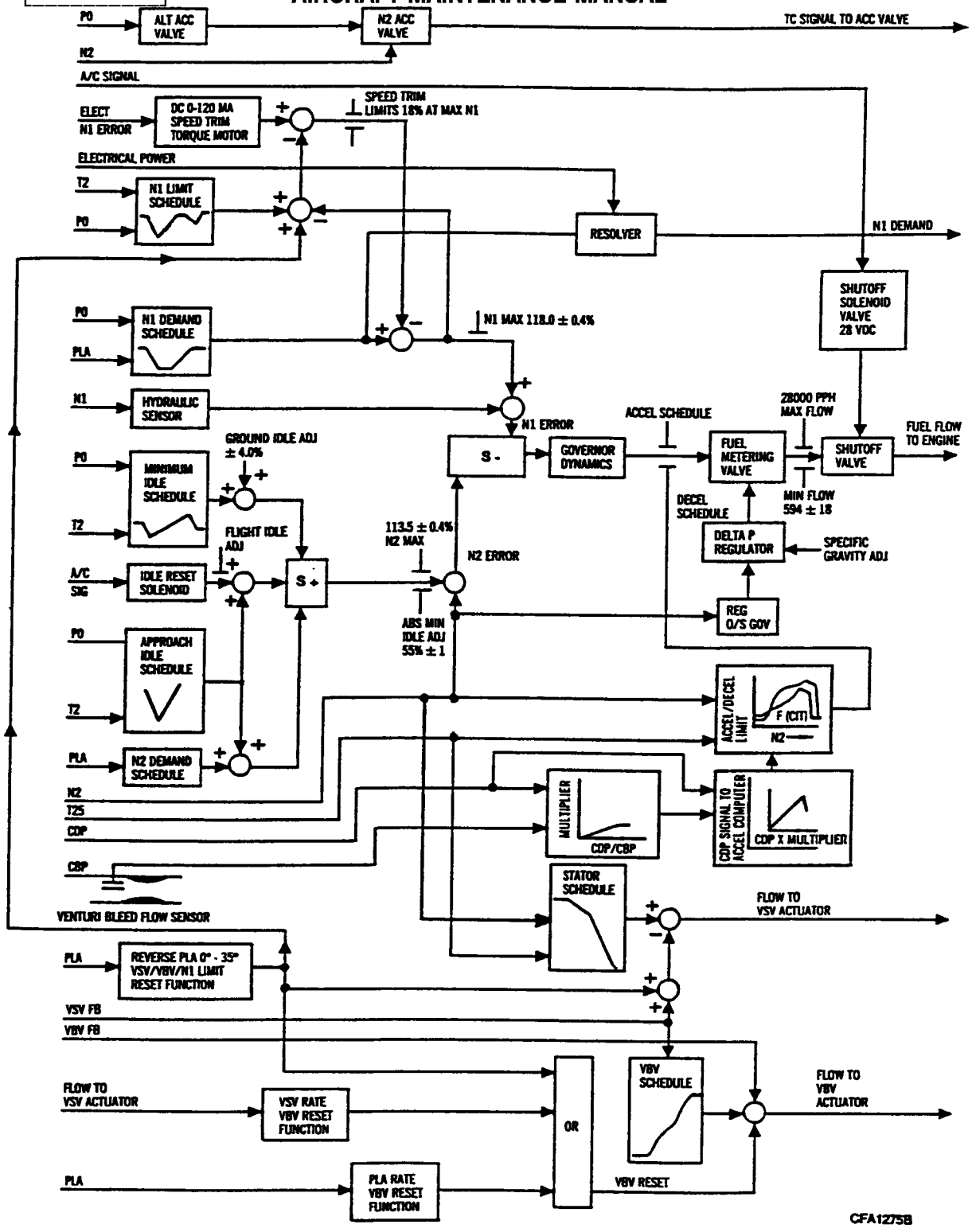
MEC - Control Block Diagram
Figure 004



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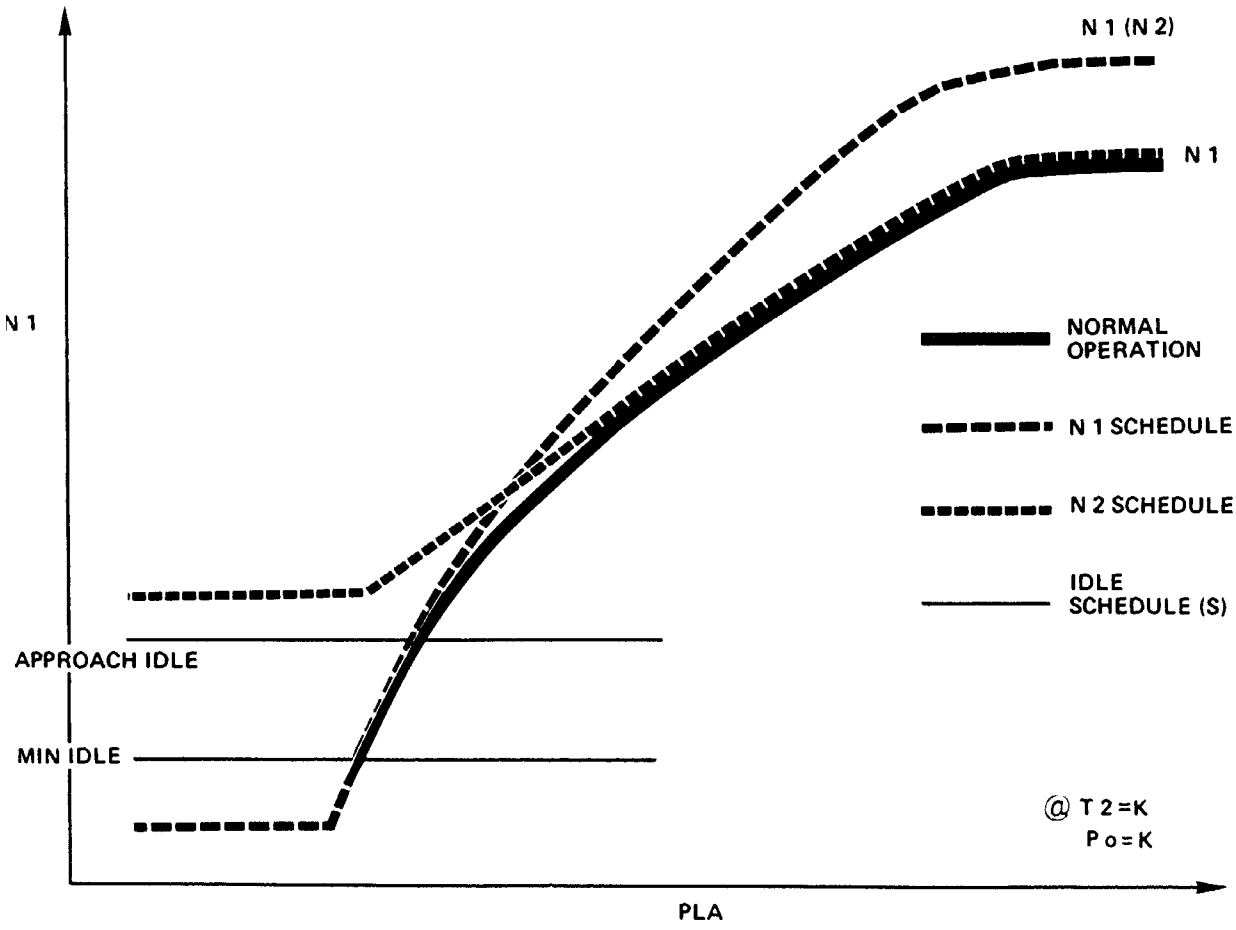
MEC Block Diagram
Figure 005



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Hydromechanical Control
Figure 006

(2)Total Temperature Sensor (T2) (Ref. Fig. 007)

(a)Description

This is a hydromechanical sensor. The sensing element is installed in the fan case at approximately the 2 o'clock position.

The T2 sensor consists of two parts :

- the sensing element located in the airstream. It consists of a sensing bulb charged with helium and a protective enveloppe
- the fuel pressure regulating valve installed on the fan case aft of the containment ring. This valve is supplied by fuel pressure P7 and delivers fuel pressure Pb.

The sensor is situated in a modified "NACA type" scoop which provides protection against dirt, sand, hail, ice ball, sheet ice and bird-strike and avoids problems in air flow path distorsion.

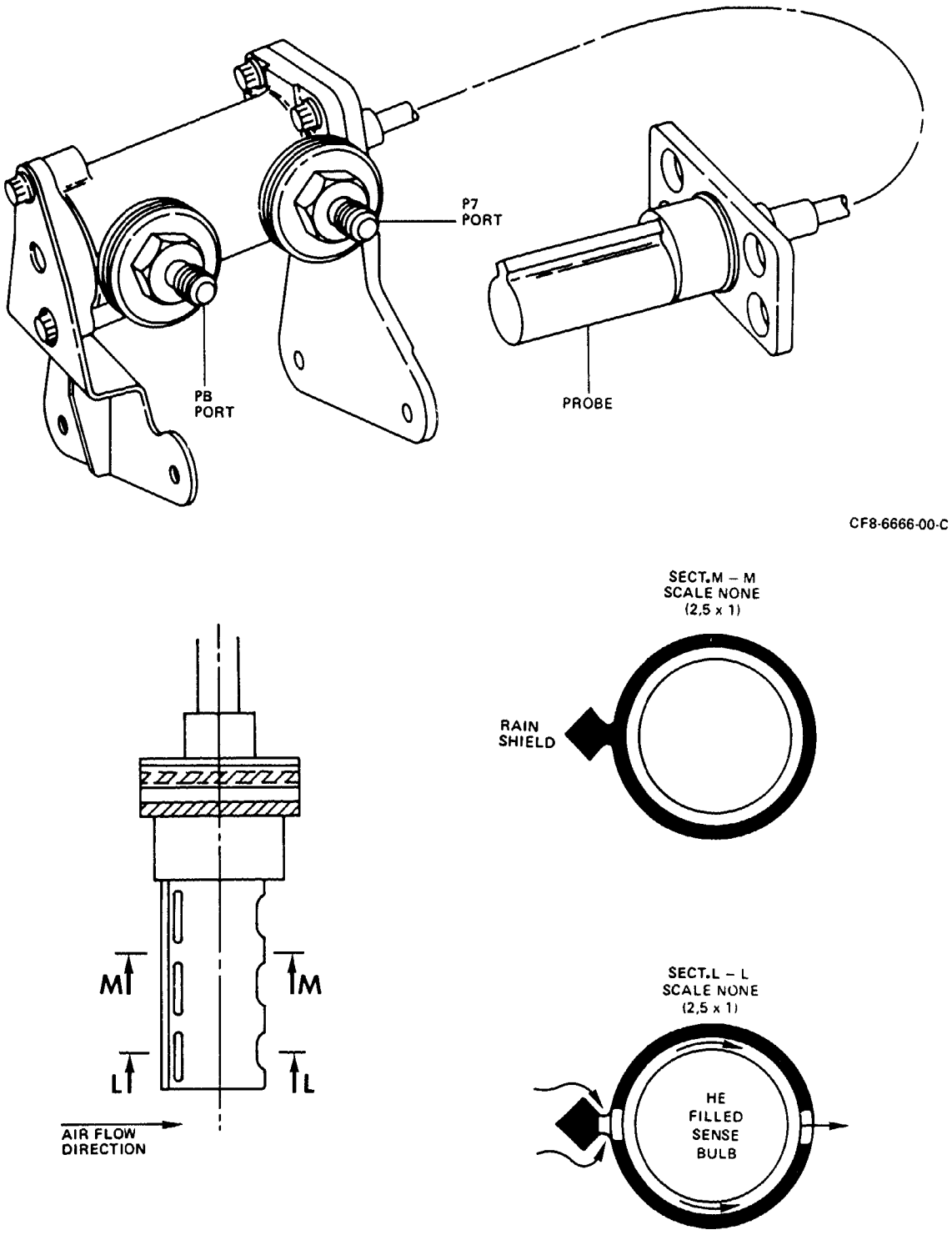
(b)Operation

The valve control is made by the action of air temperature on a given quantity of helium. The aneroid capsule connected to the sensing element acts on spring coils. Temperature drop at level of the sensing element reduces the pressure in the aneroid capsule which causes the variable section orifice to open and pressure P7 to drop.

The opposite result occurs if the temperature rises inside the sensing element. This system supplies a fuel pressure signal proportional to the fan inlet temperature.

(c)Utilization

The MEC uses pressure P7 to position N1 and N2 3D cams in rotation. The axial position of this cam is given by an altitude signal (PO). The result of these two positions is the elaboration of corrected N1 and N2 speeds which, added to the power lever position, enable stabilization of the speed demand.



T2 Hydromechanical Sensor
Figure 007

(3)Compressor Inlet Temperature Sensor (CIT) (Ref. Fig. 008)

(a)Description

This is a hydromechanical CIT sensor ; the sensing element is installed inside the fan frame at 7:30.

The sensor consists of two parts :

- The first part is a coiled tube charged with helium and located in the fan airflow. The exterior of the coiled tube is protected by an ice guard and each coil is separated by a ring to provide protection against ice blows and vibration.
  To prevent water from coming directly into contact with the tube coil, which would result in erroneous temperature values because of evaporation a conical shield made of sheet metal is located on the air inlet side of the sensing element.
- The second part is the fuel pressure regulating valve inside the engine compartment. This valve is supplied with fuel pressure P6 and delivers fuel pressure Pb.

(b)Operation

The valve is controlled by the effect of air temperature on a given volume of helium.

The aneroid capsule connected to the sensing element acts on the coils of a spring.

A temperature drop detected at level of the tube coil reduces the pressure in the aneroid capsule which causes the variable section orifice to open and pressure P6 to drop.

The opposite result occurs if the temperature rises inside the coil tube.

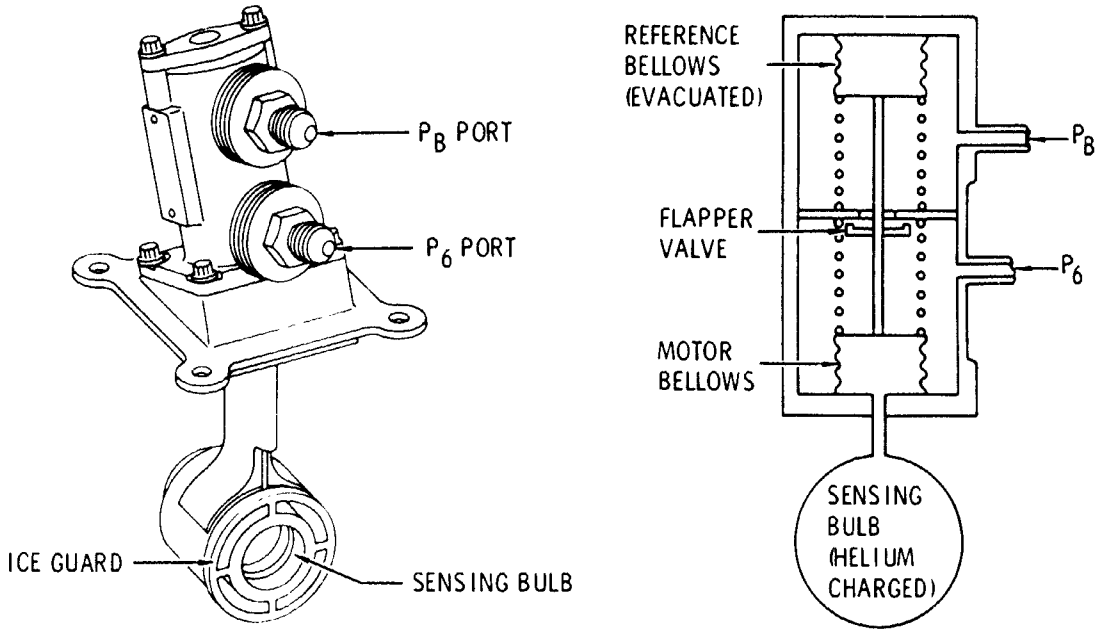
This system supplies a fuel pressure signal proportional to the air total temperature at the HP compressor inlet.

(c)Utilization

The MEC uses pressure P6 to position the acceleration limiting 3D cam side-ways which enables limitation of the fuel flow and positions the HP compressor variable stator vanes (VSV) (Ref. to paragraphs 2.A.(1)(d) and (e)).

(4)N1 Hydromechanical Sensor (Ref. Fig. 009)

The N1 hydromechanical sensor is a flyweight-operated unit driven by the LP rotor. The flyweights provide a force which positions a spring-loaded pilot valve. This valve controls fuel servo pressure to and from the sensor and sends it to the MEC (Ref. to paragraph 2A).



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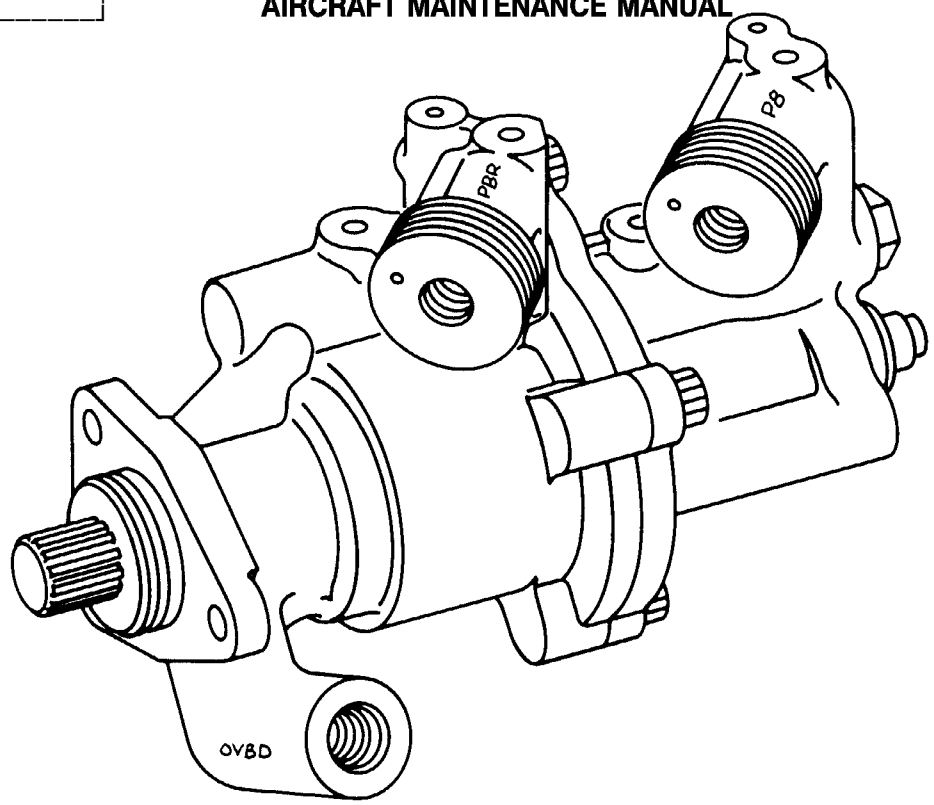
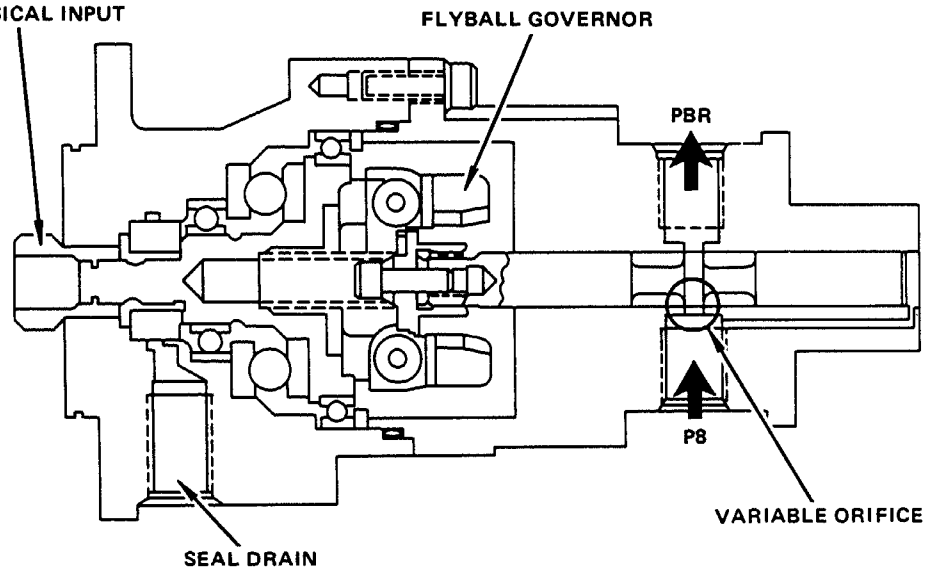
Compressor Inlet Temperature Sensor
Figure 008





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N1 Hydromechanical Sensor
Figure 009

B. Minimum/Approach Idle Control (Ref. Fig. 011, 012)
(Ref. Fig. 010)

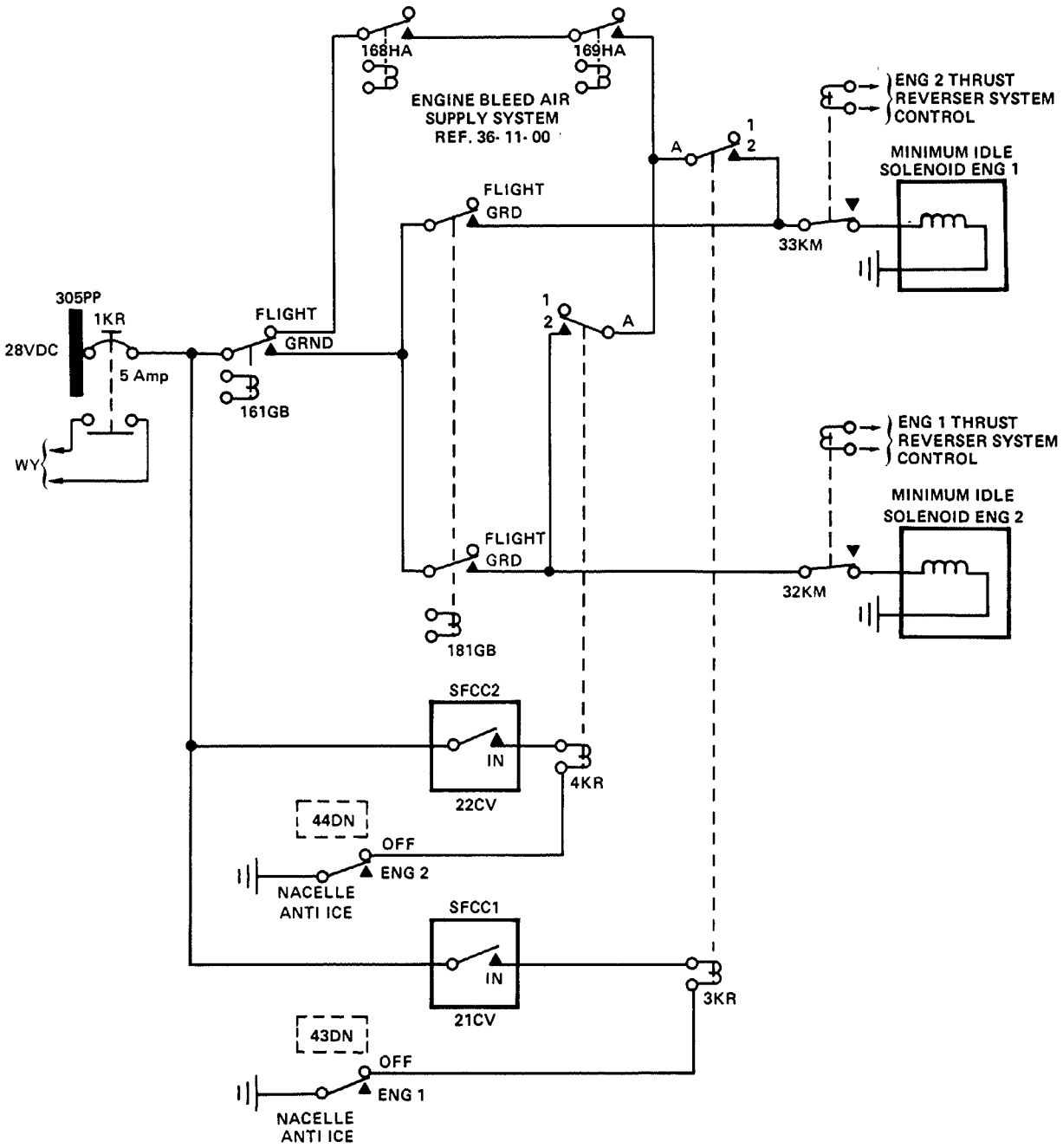
The minimum/approach idle solenoid installed on the MEC is controlled by compression of the landing gears, slats position, thrust reversers position and nacelle anti-ice selection. It displaces a piston inside the MEC which modifies the idle system adjustment.

When the landing gears shock absorber is compressed (on ground), relay 161GB and 181GB are energized which supplies the idle solenoids provided that the thrust reversers are stowed (relays 32 and 33 KM) and the engines change to ground idle.

When the landing gear shock absorber is extended (flight position), the slats retracted, anti-ice selected off and thrust reversers stowed, the engines change to minimum idle. In all other cases, the engine change to approach idle.

The idle value varies with T2 and P0.

Minimum and approach idle may be adjusted by maintenance personnel. The MEC is equipped with individual minimum and approach idle adjustment screws.



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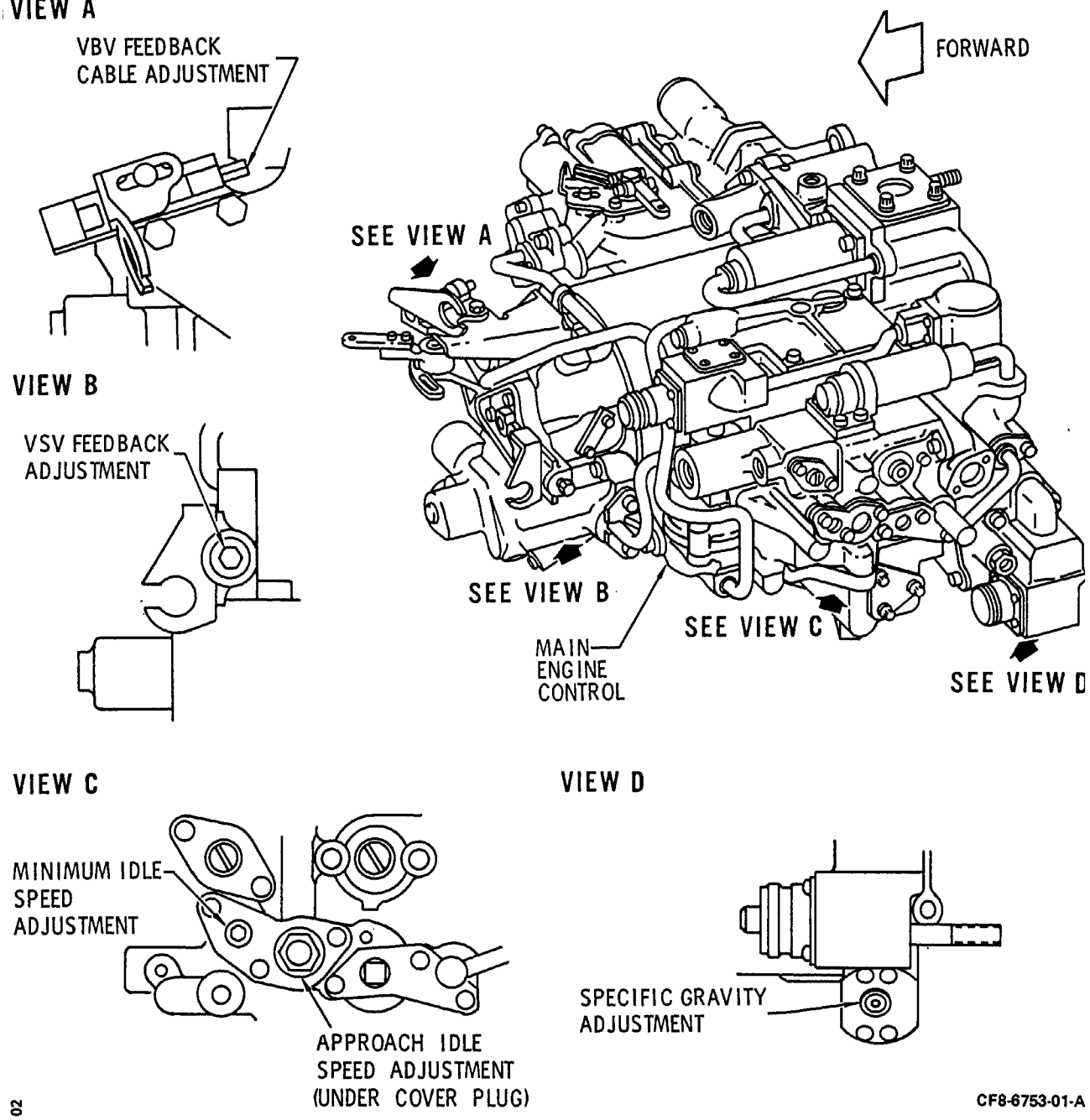
Minimum Idle - Electrical Circuit
Figure 010



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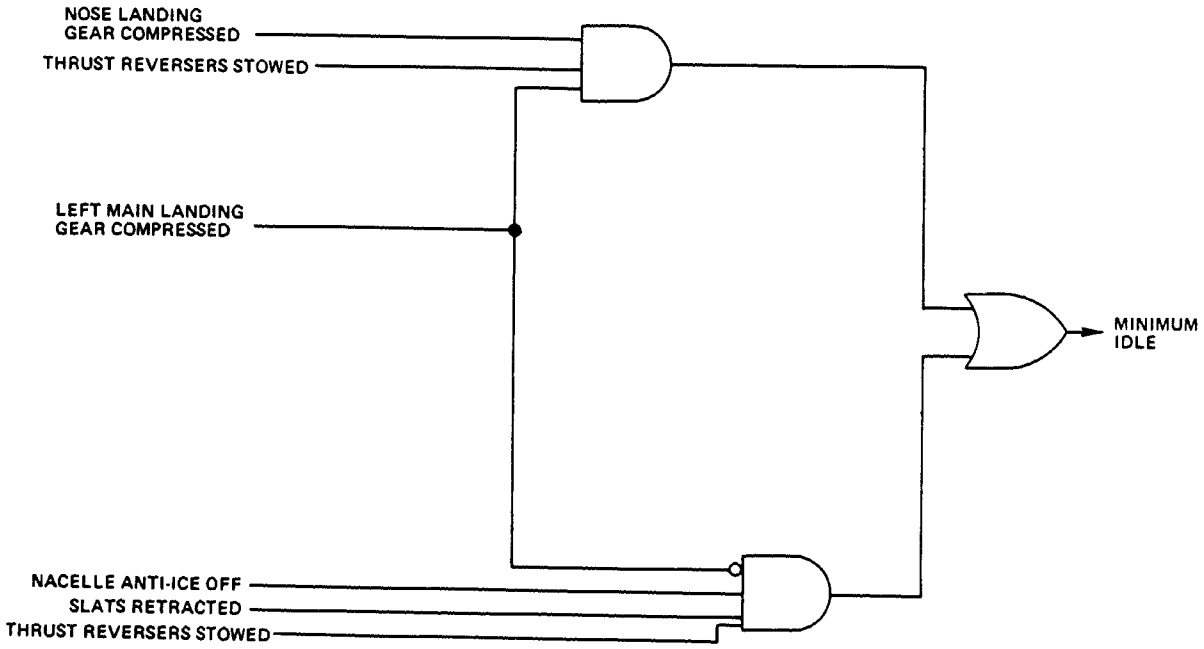
Main Engine Control Adjustment
Figure 011



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Minimum Idle Logic
Figure 012

C. Power Management Control (PMC) (Ref. Fig. 014)
(Ref. Fig. 013)

The PMC (Power Management Control) is a limited authority digital electronic trim control. It is designed to compute the rated physical N1 (fan speed) as a function of specific input parameters. It automatically trims the MEC (Main engine control) to operate the engine so that N1 actual is equal to the computed N1 (N1 Command) as modulated by the TLA (Throttle Lever Angle). The MEC now has a corrected fan speed throttle system. The MEC input parameters are PLA (Power Lever Angle), T2 (Total Air Temperature), and Po (Ambient Pressure). The PMC input parameters utilized in the computation of (N1 Command) ratings are TLA, Po, T2 and Mo (Mach Number) and engine bleed status.

The difference between PMC off and on demonstrates the limited authority of the PMC trim. The PMC has a digital interface (ARINC 429) with the avionics of the aircraft.

The PMC input parameters come from two aircraft computers (ADC or TCC) via the digital ARINC interface, and from engine sensors. The PMC has a continuous self test feature while operating on a built in input selection strategy in the event of a sensed input parameter failure. Fail fixed circuitry is provided in the PMC/MEC so that the PMC trim is locked or frozen in place in the event of a detected failure that cannot be automatically remedied by input selection strategy. The fail fixed feature minimizes changes in trim and engine thrust in the event of a sensed component failure. The value of N1 command which instantaneously follows throttle movement is transmitted to the flight compartment over the digital bus to allow rapid setting of N1 prior to engine spool up.

Also included in the self test and selection strategy is the setting of specific maintenance data bits which are transmitted to the aircraft over the digital interface bus to aid in fault diagnosis.

The PMC also has ground test capability. With the engine shut down, an aircraft ground test switch supplies aircraft power and activates the ground test mode.

The PMC is installed on the fan casing at 7 o'clock.

It is installed on dampers to prevent vibration and its chassis is electrically grounded by connection to the fan casing.

The PMC has an aluminum casing and six circuit boards, viz :

- Power supply
- Processor (A1)
- Memory and ARINC interface (A2)
- Input/Output interface (A3)
- Signal Conditioning Board (A4)
- Analog Conditioning Board (A5).

The PMC has 3 electrical connectors :

- J1 for engine interface signals (T12, N1, N1DMD, Torque Motor Current) and alternator power input.
- J2 for aircraft interface signal (Air Data Computer TCC ARINC inputs, PMC ARINC Outputs, Ground Test Power, Throttle position and PMC on/off status)
- J3 for test interface. The J3 connector has various analog and digital signals and a RS-232 interface for monitoring maintenance purposes. The J3 is capped in normal operation.

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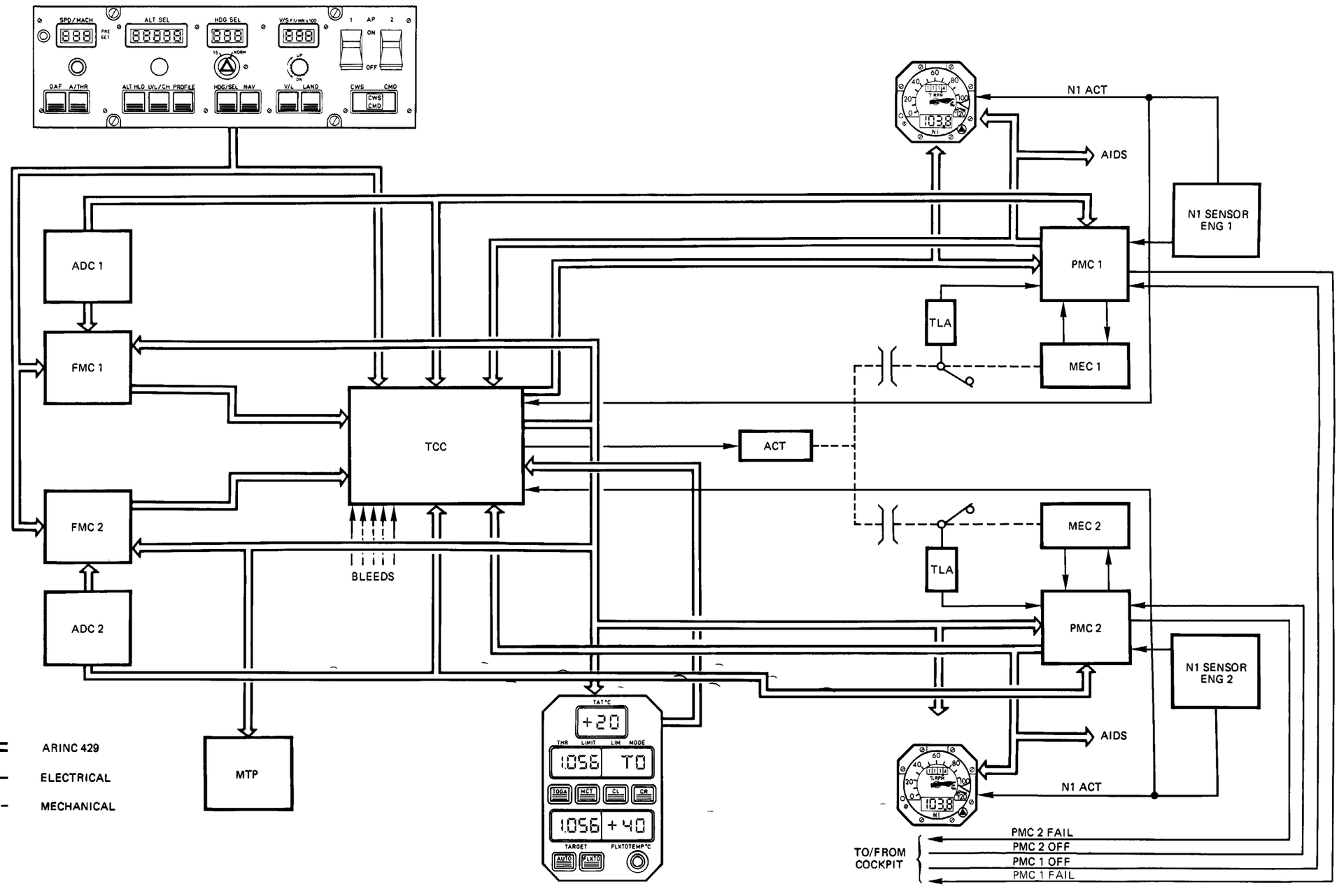

BM5 73 20 00 0 LBNO - 14 - 09
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PMC System - Schematic
Figure 013

The PMC has an ambiant pressure input given by a strain gauge type transducer.

(1)PMC Operation (Ref. Fig. 015)

(a)Inputs

The PMC receives the following data :

- digital information by data bus (ARINC 429 specification)
  . mach (MO)
  . total temperature (TAT)
  . total pressure (Pt)
  . impact pressure (q)
  from the aircraft air data computers or TCC
  . engine bleed status from the TCC.
- analog signals related to :
  . throttle control level position (TLA)
  . ON/OFF position of the PMC
  . ground test.

The analog signals for the following data are received from the engine :

- ambient pressure (PO)
- ambient temperature (T12)
- LP compressor actual RPM (N1 actual)
- N1 demand from MEC resolver.

When failure related to temperature TAT or pressure (Pt or q) sent from the ADC or TCC is detected by the PMC, T12 or PO used for computations are supplied from the engine. In the event of a mach (MO) failure, the PMC uses the "Mach default strategy" in order to minimize the effects of this failure and remain operational.

The PMC is supplied by the corresponding PMC alternator except during the ground tests when the engines are shut down ; in this case the power used is the 28 VDC supplied by the aircraft.

The PMC receives an N1DMD (fan speed scheduled by the MEC) signal from the MEC and a fan speed signal and uses them for dynamic response and stability.

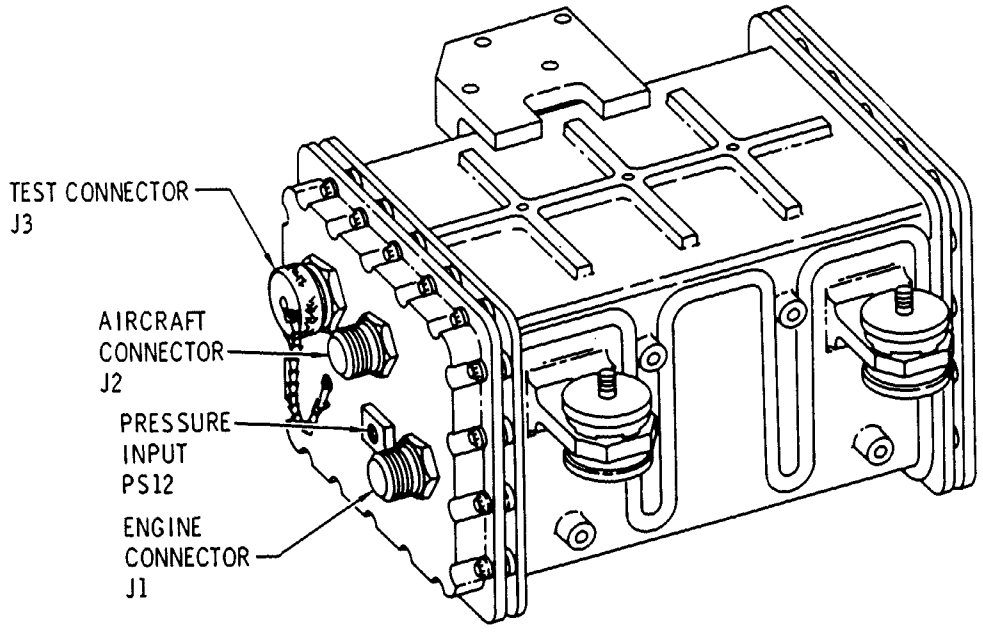
(b)Processing (Ref. Fig. 016)

The PMC computes the pressure (PO) from the following data : total pressure (Pt), impact pressure (q) supplied from the ADC and the TCC.

The PMC uses various input data (MO, PO, TAT, TLA) and the engine power management data stored in a memory to compute the N1 command for the given flight condition. The PMC compares the N1 command to the N1 actual from the engine and N1 demand from the MEC and elaborates a signal which is sent to the MEC torque motor to reduce N1 demand speed in order to equalize N1 actual and N1 command. The PMC compares TCC values with signals from engine sensors.

The input data selection logic is part of the PMC stored digital program. This logic is designed to compare input data and select that data with the highest probability of being correct for the computation of N1.

During engine start-up, the PMC will undergo normal program initialization before the engine-driven alternator reaches idle speed. During the engine start the PMC is fully operational with respect to



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BM5 73 20 00 0 LDNO-13-07
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Power Management Control Unit
Figure 014

self test and the computed N1 CMD. Thus the PMC N1 error signal is in the direction to decrease the speed trim and the engine is operated at idle speed by the MEC. Since N1 limit is available on the PMC digital bus at this time, it is possible to determine that the computed N1 CMD with TLA at maximum position will exceed the required take off N1.
The engine continues to operate on the HMC fuel schedule until the PMC schedule for N1 initiates down-trim torque motor current above approach idle speeds. The PMC continues to schedule N1 in flight.

(c)Detected Failures

- Detected failures which do not significantly affect PMC or system performance will be identified on specific maintenance data words, but will not result in other PMC failure action.
  In the case of input parameters which have extremely slow response as compared to the 10 millisecond PMC cycle time (such as T2 or Po), the PMC failure sequence will be delayed by a counter to avoid unwarranted failure action on instantaneous data errors which do not repeat. The previous value of valid data will be utilized for N1 computation during this delay period.
  For failure detection of parameters which can have an immediate effect upon engine operation, the PMC will activate FAULT amber legend on ENG TRIM pushbutton switch located on flight compartment overhead panel (Ref. Fig. 017) and initiate the failure sequence to maintain the pre-failure value of torque motor current to maintain the scheduled speed trim.
  The status matrix of output parameters will indicate invalid data on all parameters which could be caused by the failure.
  These conditions (fail light on, and torque motor current held constant) prevail and are latched regardless of the subsequent status of the failed parameter. Full MEC operation and control is available except MEC N1 according to the N1 schedule at the time of failure.
  PMC is deactivated by pressing ENG TRIM pushbutton switch which causes OFF legend to come on (white) and causes the power supply to the MEC torque motor to drop to zero.

(d)Ground Test

- The PMC operation can be checked on ground. When the engine is shut down, a ground test switch supplies 28 VDC aircraft electrical power which activates PMC ground test mode. In ground test, the PMC computes N1 command as in normal operation ; sets N1 actual ARINC output equal to N1 command. It also sends the N1 command and N1 actual digital signals to the indicator. When the throttle control levers are moved simultaneously, the pointers of the N1 RPM indicators move accordingly which enables a comparison of the PMC system operation of one engine with respect to the other.
  During this ground check, the PMC self-monitoring system is fully operational and indicates the detected faults.
  Furthermore, the PMC comprises a disabling circuit which prohibits the ground tests if the alternator is in operation (engine running).
  The PMC also has a thermal switch which prevents extended ground test operation in hot day ambient conditions.

(e)Non Volatile Memory (NVM)

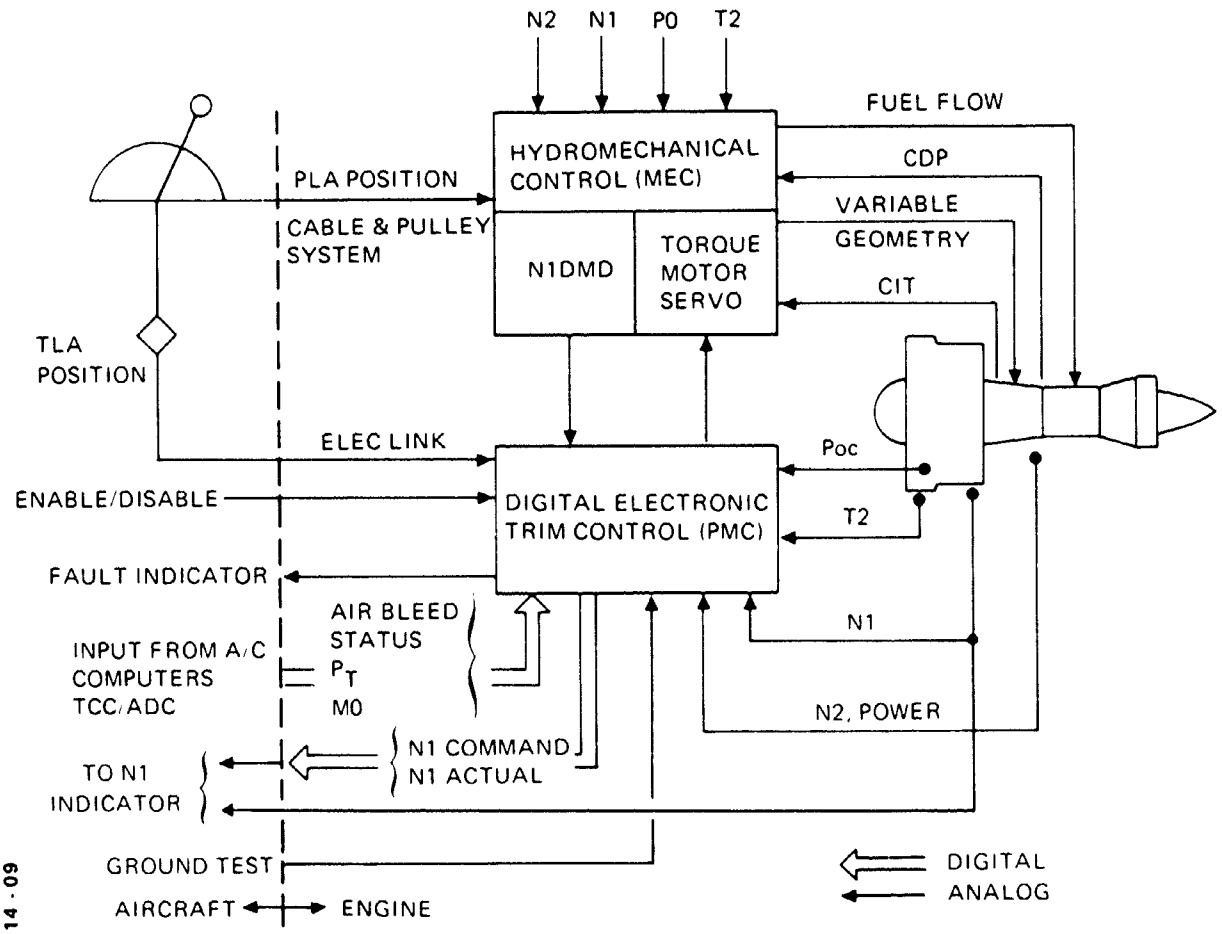
The PMC is equipped with a non volatile memory (FIFO type) which stores a set of data including 5 maintenance and system discrete words and 8 sensor values (N1, N2, T12, Po, TLA, N1DMD, MO AND TMC) and flight counter when a system fault is detected. The NVM maintains 7 sets of data resulting from the last 7 flights.
Last set is addressable from ARINC while in ground test with PMC disabled. Current status is addressable from ARINC while in ground test with PMC enabled. Six remaining sets of data are available from RS232 port on test connector.
NVM undergoes self test during power initialization.
Failure of this test results in maintenance bits being set, but no FAULT action.

(f)Outputs

The PMC sends :

- under the analog form :
  . the 28VDC supply signal to the PMC fault solenoid
  . power supply to the FAULT legend of ENG TRIM pushbutton switch
  . the trim electrical signal which controls the MEC torque motor
- under the digital form : by busbar ARINC 429
  . the N1 command, N1 max., N1 actual to the N1 : RPM indicator and to the AIDS system
- under the digital form ; by busbar ARINC 429
  . the parameters listed in the appendix, table 3 to the TCC.

NOTE : Details for the busbars are given in the appendix.



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PMC System Schematic
Figure 015

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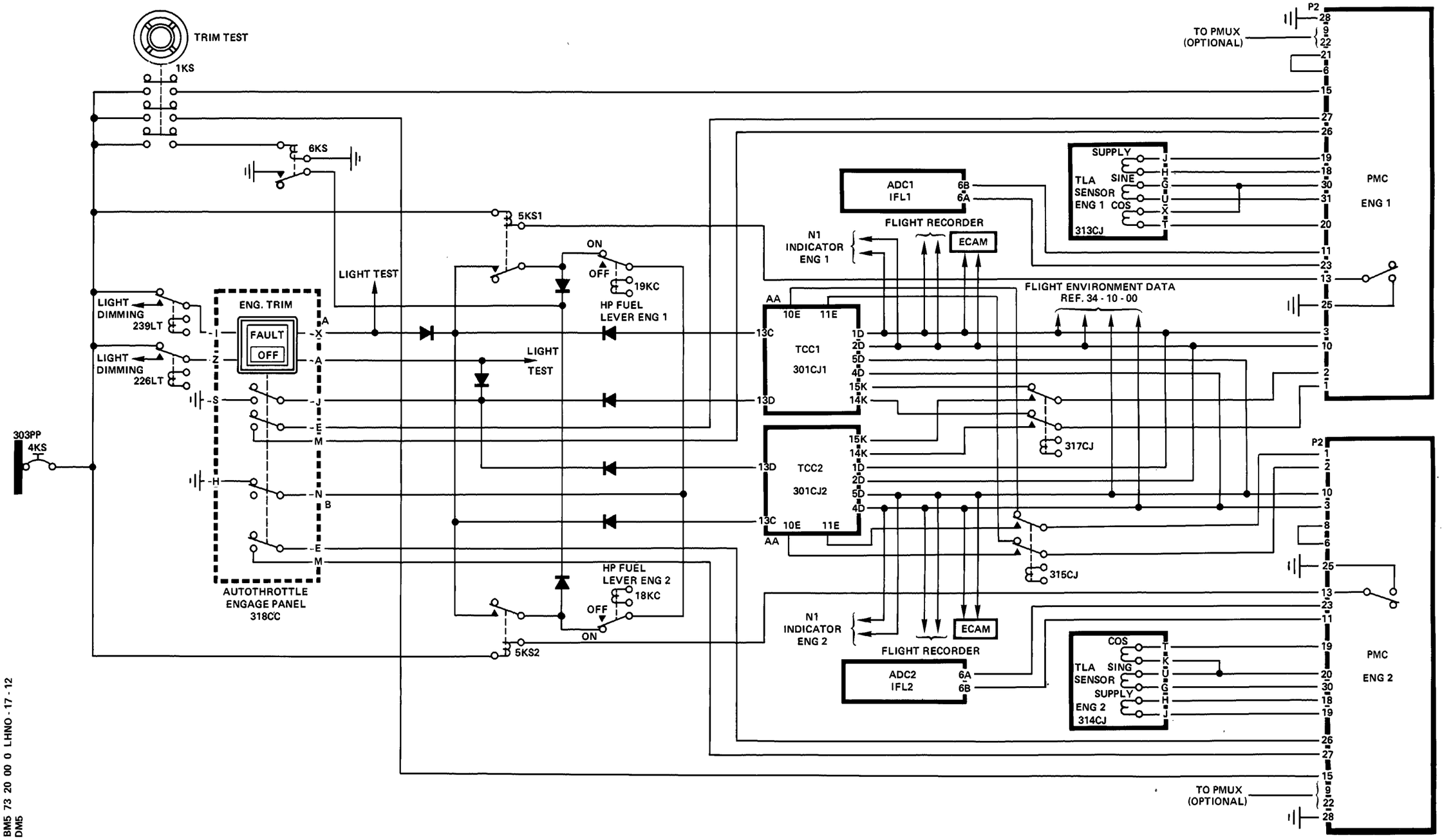

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PMC Electrical Circuit
Figure 016

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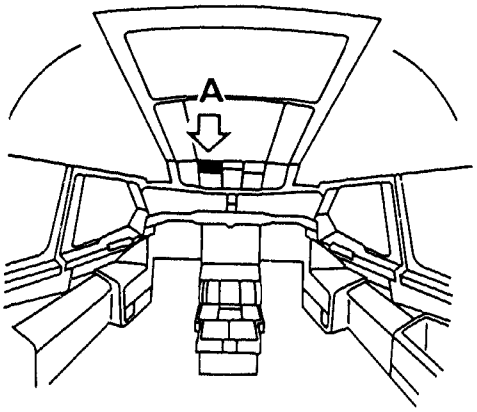

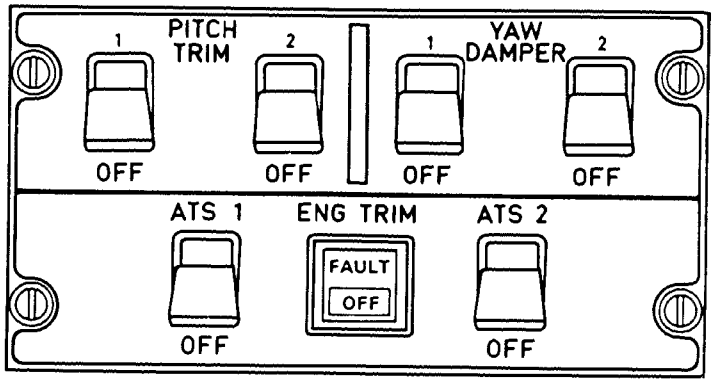

BM5 73 20 00 0 LKNO-13-08
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ON/OFF Switch Location
Figure 017

(2)Electrical Temperature Sensor (T12)
PRE SB GE 73-097 (Ref. Fig. 018, 020)
POST SB GE 73-097 (Ref. Fig. 019, 021)
The electrical temperature sensor (T12) is installed on the fan case at 10:30.

(a)Description
The sensor consists of a ceramic body on which a platinum resistor is wound.
This resistor is supplied in 10VDC by the PMC with a constant current intensity of 12.5 mA.
The sensor is situated in a modified "NACA type" scoop to protect it against dirt, sand, hail, ice ball, sheet ice and birdstrike and avoid problems in airflow pass distortions.

(b)Operation
A temperature variation at the fan inlet causes the platinum resistor to vary which results in a variation of the circuit voltage.
The sensor transmits an electrical signal to the PMC which is proportional to the air temperature at the fan inlet.

(c)Utilization
The PMC will use temperature T12, in the event of faulty temperature TAT transmitted from the ADC or TCC, to compute N1 command and N1 max.

(3)Busbar ARINC 429 from the ADC/TCC to the PMC
Tables 1 and 2 give the parameters carried by this data bus and the characteristics of the digital words (label, measurement range, resolution) related to these parameters.

(4)Data Bus ARINC 429 from the PMC to the TCC, N1 - RPM Indicator and AIDS System
Tables 3 and 4 give the parameters carried by this data bus and the characteristics of the digital words (label, measurement range, resolution related to these parameters).
Aircraft Data

Signal	Signal Format	Signal Source	Bit Rate	Maximum Transport Delay (msec)	Octal Label
Mach	BNR	ADC/TCC	Lo	200	205
Total Air Temp	BNR	ADC/TCC	Lo	500	211
Impact Pressure	BNR	ADC/TCC	Lo	200	215
Total Pressure	BNR	ADC/TCC	Lo	200	242
Bleed Discrete	DISCRETE	TCC	Lo	62.5	273

Table 1

Signal	Minimum Update Rate (SPB)	Sign. Bits	Binary Range	Approx Reso-lution	Accu-racy	Units	(Ref) Oper Rang.
Mach	8	13	±4.096	Note 1	Note 2	Mach	Note
Total Air Temp.	2	11	±512	0.25	±0.4	°C	

Signal	Minimum Update Rate (SPB)	Sign. Bits	Binary Range	Approx Reso-lution	Accu-racy	Units	(Ref) Oper Rang.
					Ground		
Impact Pressure	8	9	±512	1.0	0.1	mb	
Total Pressure	8	11	±2048	1.0	0.7	mb	

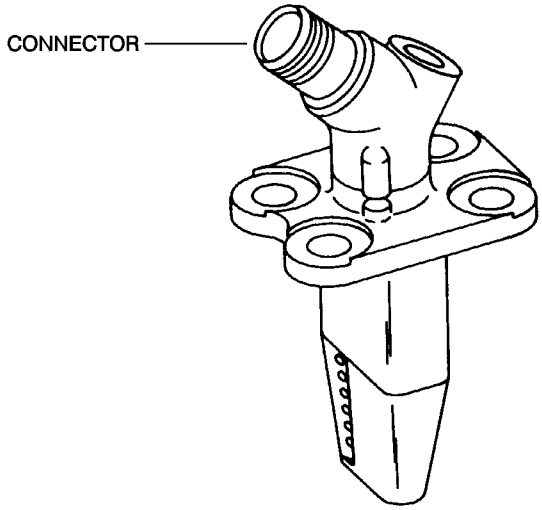
Table 2

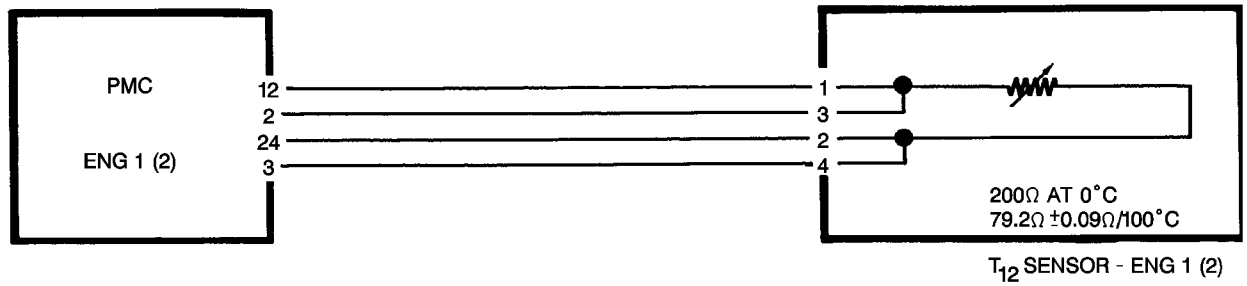
NOTE :
1. Below Mach 0.1 data field indicates zero and SSM indicates no computed data. Mach resolution is 0.002 Mach from 0.1 to 0.2 Mach ; and 0.07 Mach above 0.2 Mach.
2. Mach accuracy shall be as follows :
   ±0.010 Mach at 0.15 Mach
   ±0.005 Mach at 0.60 Mach
   ±0.004 Mach at 0.70 Mach for altitude of 20,000 feet to 40,000 feet.
   ±0.003 Mach at 0.80 Mach for altitude of 25,000 feet to 45,000 feet.

PMC Data Link

Signal	Signal Format	Signal Source	Bit Rate	Maximum Transport Delay (mSec)	Octal Label
N1 Actual	BNR	PMC	Lo	122	346
T2 Engine	BNR	PMC	Lo	190	130
TLA Resolver	BNR	PMC	Lo	214	133
Po Engine	BNR	PMC	Lo	185	217
N1DMD	BNR	PMC	Lo	125	343
N2	BNR	PMC	Lo	95	344
N1 Max	BNR	PMC	Lo	95	342
N1 CMD	BNR	PMC	Lo	60	341
System Discrete	DIS	PMC	Lo	N/A	270
System Discrete	DIS	PMC	Lo	N/A	271
TM Current	BNR	PMC	Lo	115	304
N1 Error	BNR	PMC	Lo	185	305
N1 Integrator	BNR	PMC	Lo	124	306
N1 Corrected	BNR	PMC	Lo	175	307
Maintenance Data	DIS	PMC	Lo	N/A	350-354
Flight Counter	BNR	PMC	Lo	N/A	251

Table 3 (PMC data link)





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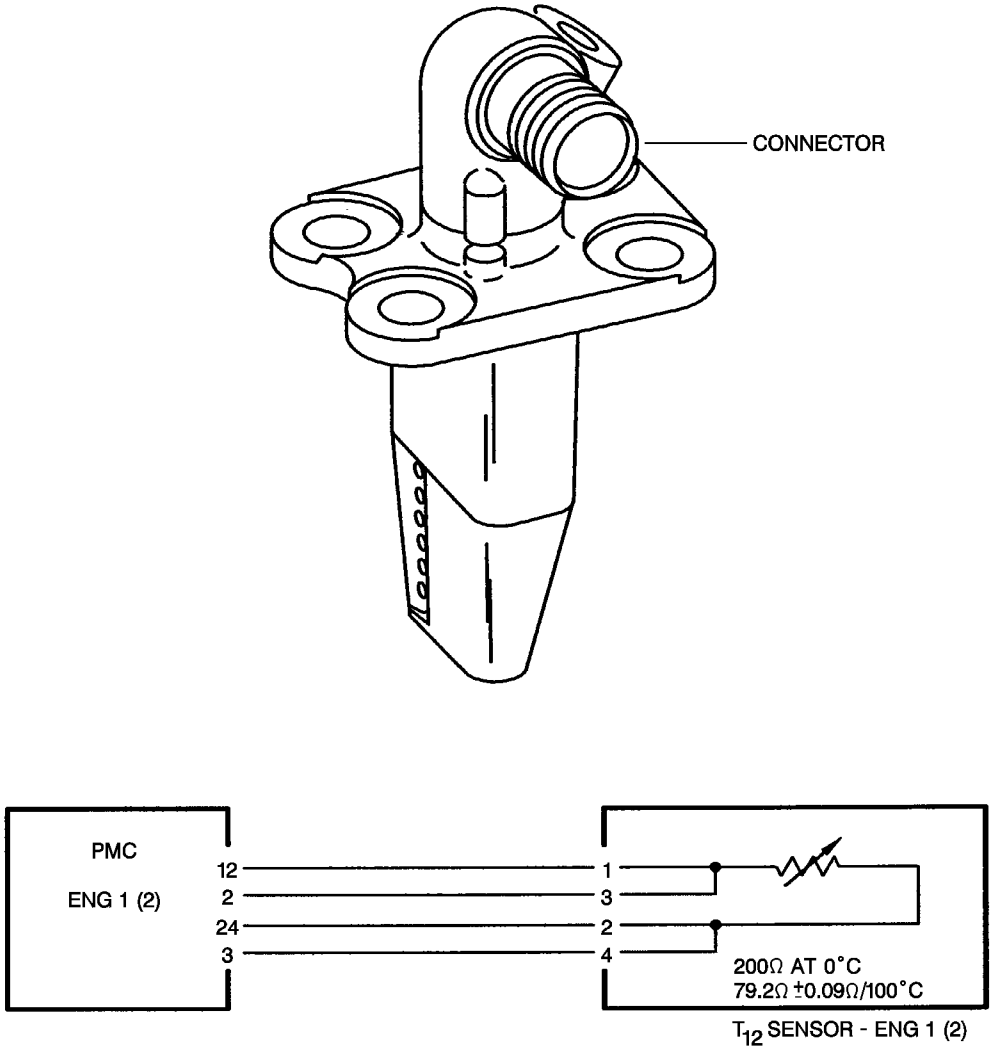
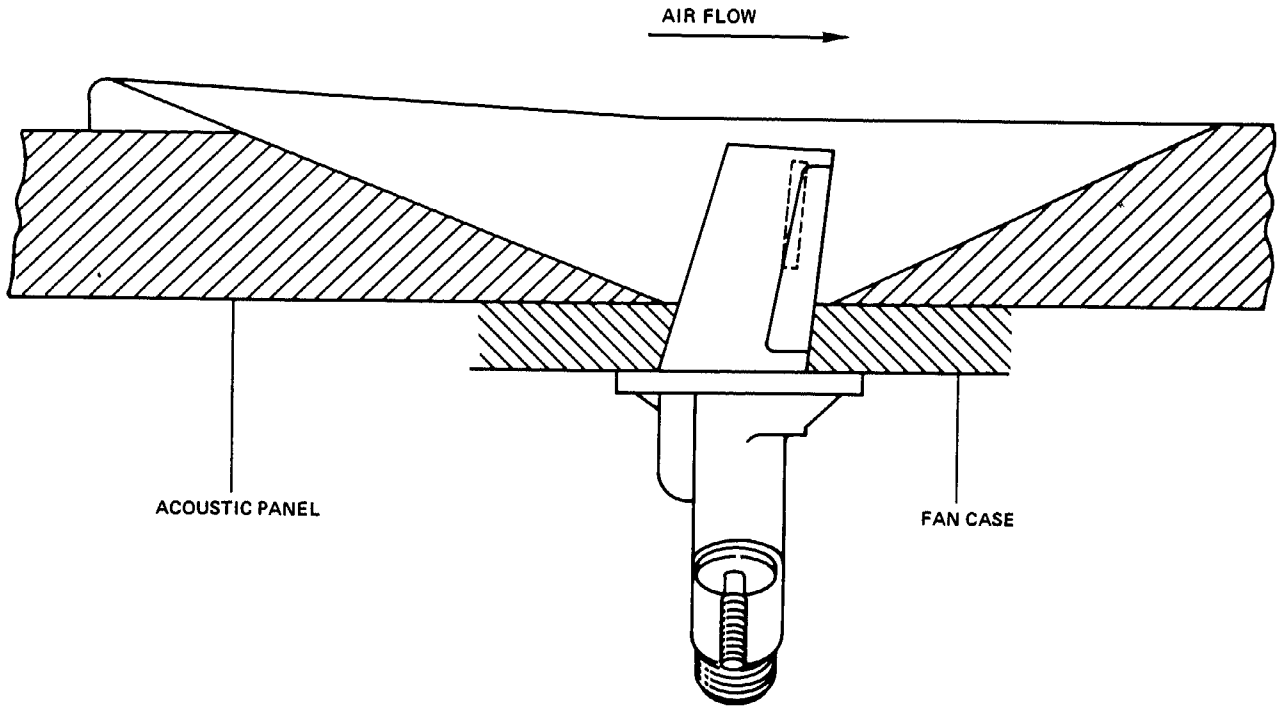
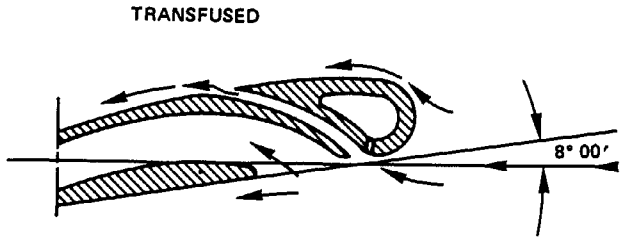
T 12 Sensor - Electrical Circuit (Pre SB GE 73-097)
Figure 018



BM5 73 20 00 0 LMU0 01

T 12 Sensor - Electrical Circuit (Post SB GE 73-097)
Figure 019





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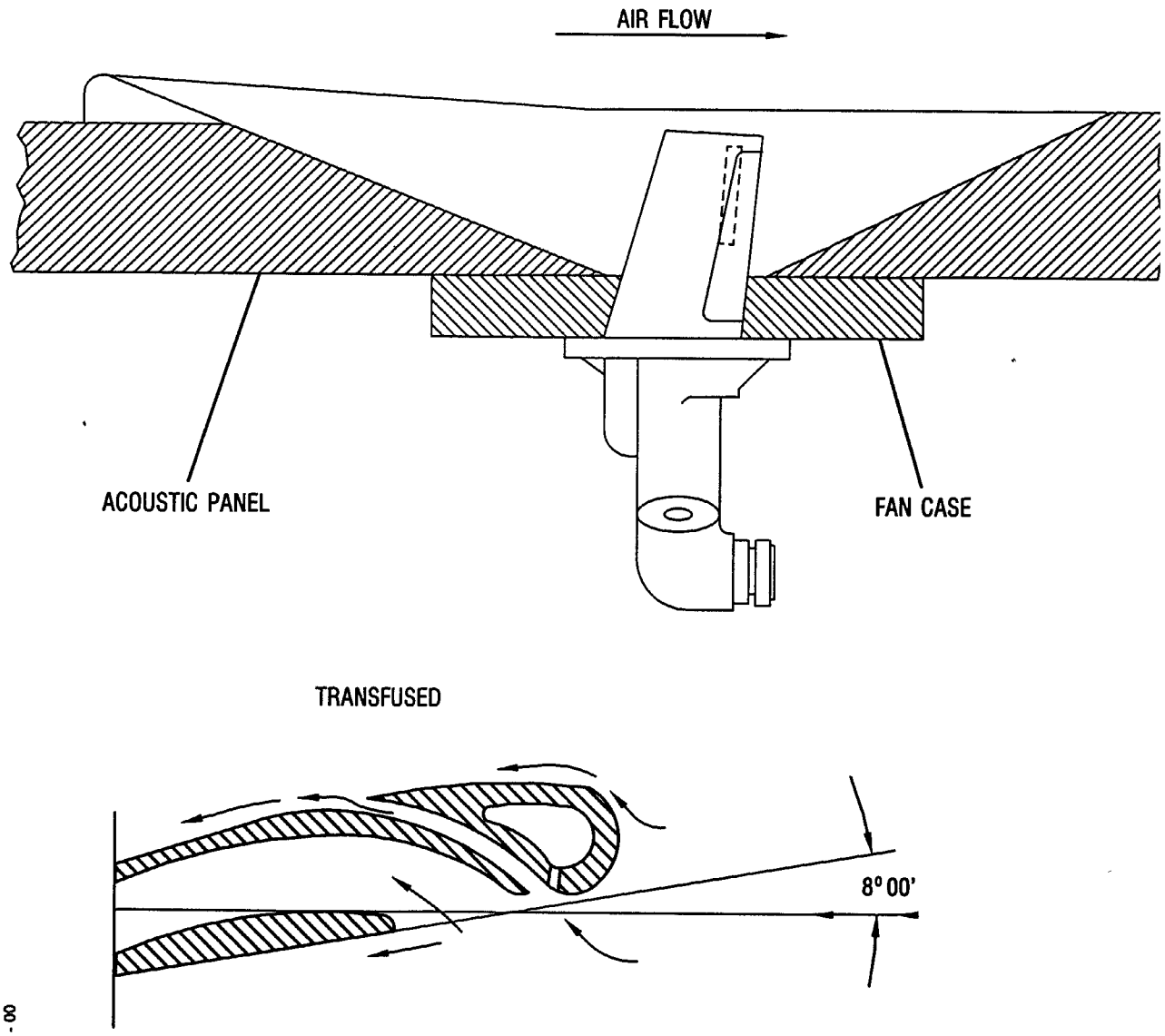
T 12 Sensing Scheme (Pre SB GE 73-097)
Figure 020



BMS 73 20 00 0 LQUO - 00

T 12 Sensing Scheme (Post SB GE 73-097)
Figure 021

Signal	Minimum Update Rate (SPB)	Sign. Bits	Binary Range	Approx Reso-lution	Accu-racy	Units	(Ref) Oper Rang.
N1 Actual	16	12	+256	0.0625	±0.20 See Note 1	% rpm	20 to 110
T2 Engine	8	12	±512	0.125	±1.0	C	- 76 to + 84
TLA Resolver	8	12	±512	0.125	±0.5	deg	5 to 85
Po Engine	8	12	+64	0.1563	±0.4	in.Hg	1.65 to 32.57
N1DMD	25	12	+256	0.0625	±1.5	% rpm	20 to 110
N2	16	12	+256	0.0625	±2.0	% rpm	50 to 110
N1 Max	25	12	+256	0.0625	±0.14	% rpm	80 to 110
N1 CMD	50	12	+256	0.0625	±0.14	% rpm	20 to 110
System Discrete	8	12	-	-	-	-	-
System Discrete	8	12	-	-	-	-	-
Tm Current	16	12	+153.6	0.0375		mA	5 to 95
N1 Error	8	12	±4096	1.0		rpm	- 2044 to + 2044
N1Integrator	8	12	±8192	2.0		rpm	- 1864 to + 4148
N1 Corrected	8	12	+256	0.0625	±0.14	% rpm	12 to 144
Maintenance Data	8	12	-	-	-	-	-

Table 4

(5)Electrical Supply : PMC Control Alternator/N2 Speed Sensor
The PMC control alternator is a conduction cooled, permanent magnet, single phase, bearingless machine. It is mounted on and driven by the accessory gearbox. Three separate windings supply : electrical power to the engine mounted power management control, electrical power to the engine mounted propulsion multiplexor (PMUX), core speed (N2), signal to the PMC and the flight compartment.
The separate 12 - pole permanent magnet rotor is mounted on a rotating shaft which projects from the engine gearbox. Rotation of the rotor causes changes of flux in the stator laminations, thus inducing voltage in the stator coils. The rotor speed and therefore alternator frequency are directly proportional to the engine core speed. Output characteristics are as follows :

Winding	Frequency Hz.	Output Volts	(RMS) AMPS
I	685	10.5 min.	6 min.
(Control	1824	65 max.	0
Power PMUX)	1824	0	9 max.
II	685	47.5 min.	2 min.
(Control	1824	210 max.	0
Power PMC	1824	0	3.5 max.
III	45.7	0.88 min.	11×10^{-4} min.
(Speed	1824	35 max.	0
Signal)	1824	0	0.25 max.

The alternating current from the alternator is rectified and stabilized within the PMC.

MAIN ENGINE CONTROL - REMOVAL/INSTALLATION

1. General

A. The following instructions are for the removal and installation of the main engine control (MEC) from the engine.
Access to the MEC is gained by opening the right thrust reverser cowl (Ref. 71-13-00, P. Block 301).

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Container (5 Gal), (19 Liters)
C.	Caps and Plugs
D. 2C14797 or 2C14852	Fixture, Install/Remove - Main Engine Fuel Control
E. Material No.C02-004	Anti-Seize Compounds, Lubricants Oils (Ref. 70-00-00)
F. Material No.C02-058	Anti-Seize Compounds, Lubricants Oils (Ref. 70-00-00)
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors
- 73-21-01, P. Block 501	Main Engine Control
- 76-11-62, P. Block 401	Throttle Control Box

3. Procedure

A. Job Set-up
(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
22VU	ENG 1 & 2/TRIM WARN	4KS	207/C21

(2)Open, safety and tag the appropriate circuit breakers and Open Fan and Thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

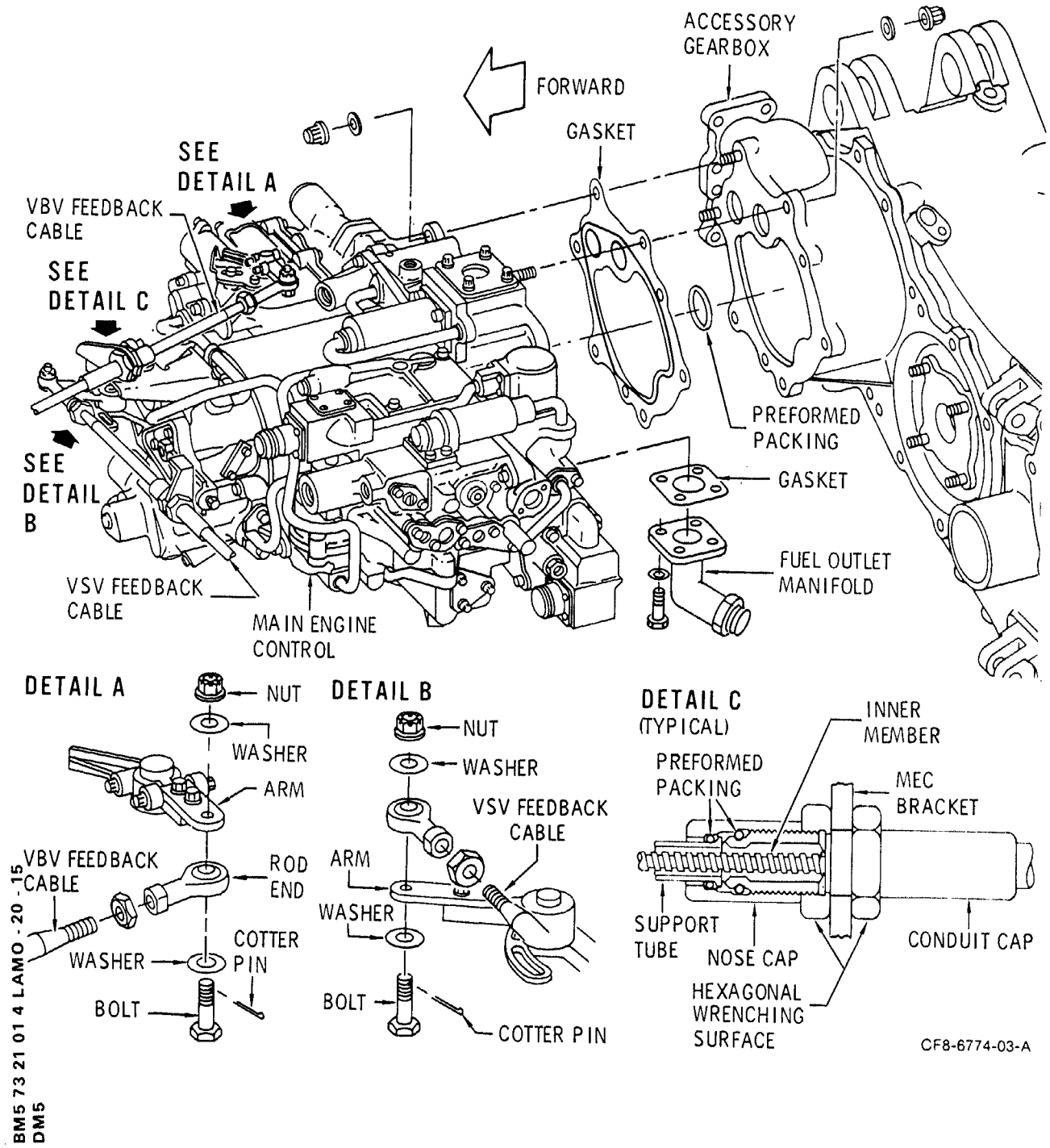
B. Removal (Ref. Fig. 401, 402, 403)
(1)Drain MEC fuel outlet tube as follows :
(a)Position container under MEC fuel outlet tube drain cap.
(b)Remove drain cap from fuel tube and drain residual fuel into container.
(c)Install drain cap on fuel tube and TORQUE cap to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
Wirelock cap.
(2)Disconnect the following from the MEC :
(a)Throttle control box (Ref. 76-11-62, P. Block 401)
(b)Inlet temperature (T2) sensor return (PB) tube.
(c)Fan speed (N1) sensor return (PBR) tube (hydro-mechanical).

(d)Compressor inlet temperature (CIT) sensor signal (P6) tube.
(e)Variable stator vane (VSV) rod-end tube.
(f)VSV head-end tube.
(g)T2 sensor (P7) signal tube.
(h)N1 sensor (P8) signal tube.
(i)Variable bypass vane (VBV) feedback cable rod end at MEC by removing cotter pin, nut, washer and bolt.
(j)VSV feedback cable rod end at MEC by removing cotter pin, nut, washer and bolt.
(k)VBV rod-end tube.
(l)VBV head-end tube.
(m)Fuel outlet manifold by removing bolts and washers.
(n)Pressure case regulator (PCR) signal tube.
(o)Turbine clearance (Tc) signal tube.
(p)Overboard drain tube.
(q)Shutoff/IRS electrical connector.
(r)Torque motor/resolver electrical connector.
(s)Both ends of the compressor discharge pressure (CDP) tube and remove (Ref. Fig. 407).
(t)Both ends of the compressor bleed pressure (CBP) tube and remove (Ref. Fig. 407).
(u)Disconnect VBV and VSV feedback cable from MEC trimmer bracket as follows : (Ref. Fig. 401, 402, 403)
NOTE : Ensure that cable end fittings are clean and free of foreign material to avoid damage to inner member.
1 Remove lockwire and remove nose cap assembly by using two wrenches. Hold the conduit cap hex wrenching surface stationary while loosening and removing the nose cap/support tube assembly.
NOTE : Keep nose cap support tube and preformed packing together. Do not separate.
2 Remove cable from MEC bracket, using care not to damage exposed inner member.
3 Reinstall the support tube assembly on the cable, finger tight.
WARNING : ASSEMBLY WEIGHT IS APPROXIMATELY 74 LBS (33.6 KG).
CAUTION : WHEN REMOVING THE MEC FROM GEARBOX ADAPTER PAD, USE CARE TO PREVENT MEC VSV HEAD AND ROD END NIPPLES FROM BEING DAMAGED BY CONTACT WITH BRACKET.
CAUTION : SUPPORT ASSEMBLY DURING REMOVAL TO PREVENT SPLINE DAMAGE.
(3)Remove MEC from gearbox mounting pad.
(a)Attach install/remove fixture, 2C14797 or 2C14852 to MEC.
(b)Remove nuts and washers from MEC and accessory gearbox studs.
(c)While supporting the MEC with the install/remove fixture, carefully move MEC forward and off mounting flange.
(d)Discard preformed packing removed from MEC spline.
NOTE : MEC mounting gasket may be reused if found to be serviceable.
(4)Remove unions and discard preformed packings from the following ports. Unions may be retained for reuse.
(a)VSV rod-end and head-end ports.
(b)VBV rod-end and head-end ports.
(c)T2 (P7) signal port.
(d)CDP signal port.

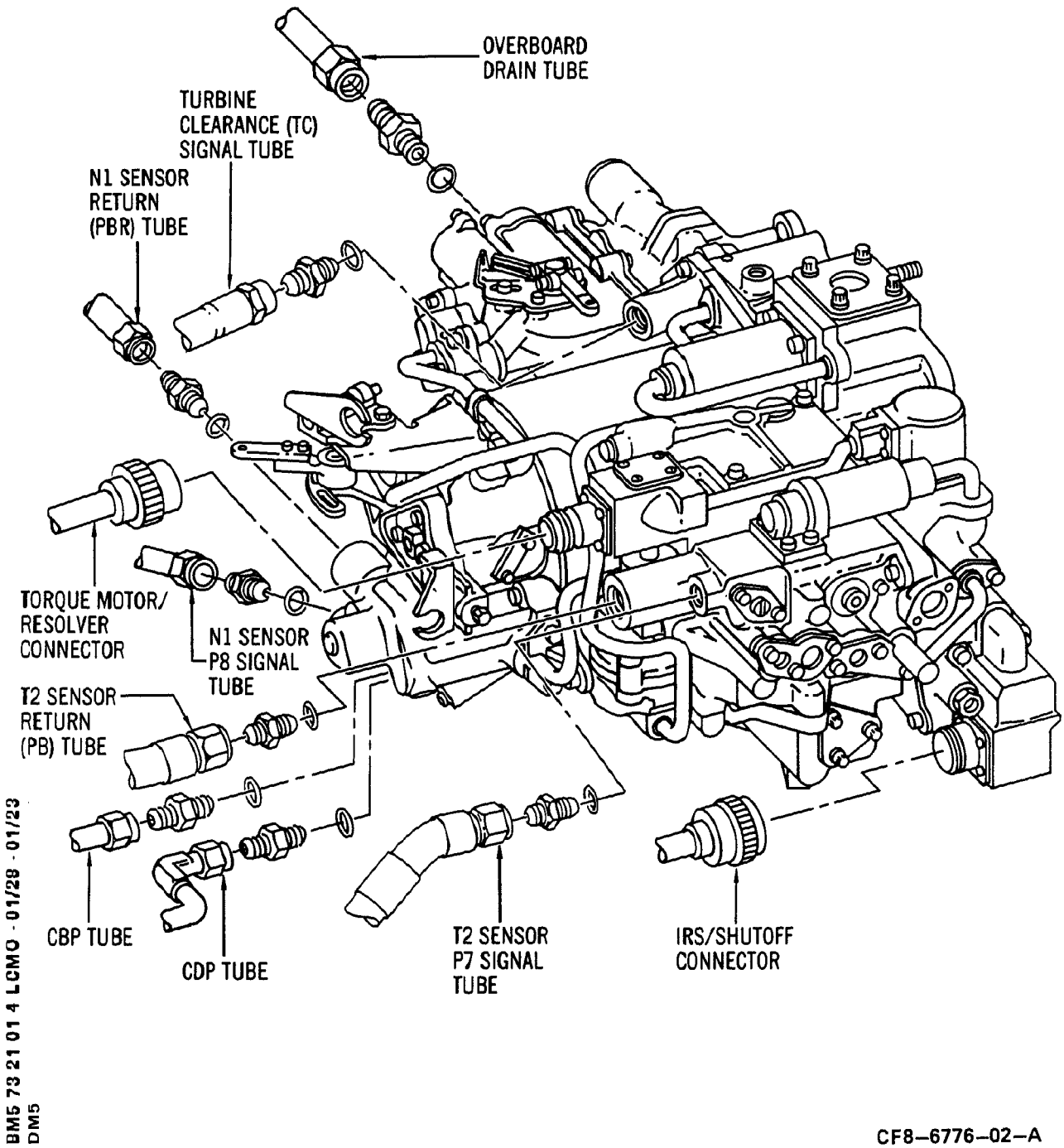
(e)Overboard port.
(f)T2 sensor return (PB) port.
(g)CIT sensor signal (P6) port.
(h)PCR port.
(i)P8 signal port.
(j)PBR port.
(k)Tc signal port.
(l)CBP port.
(5)Protect all openings with caps or plugs.
(6)Remove MEC from install/remove fixture 2C14797 or 2C14852.

C. Installation.
NOTE : Fuel components that have Fluorocarbon (Viton) external seals (SB 73-079) can leak for a short period of time when they are below -29°F (-34°C). If a leak occurs, continue the start to idle.
- If the fuel leakage stops in less than 5 minutes at idle, continue operation of the engine.
- If the fuel leakage continues after 5 minutes at idle, shut down the engine and repair the source of the leakage.

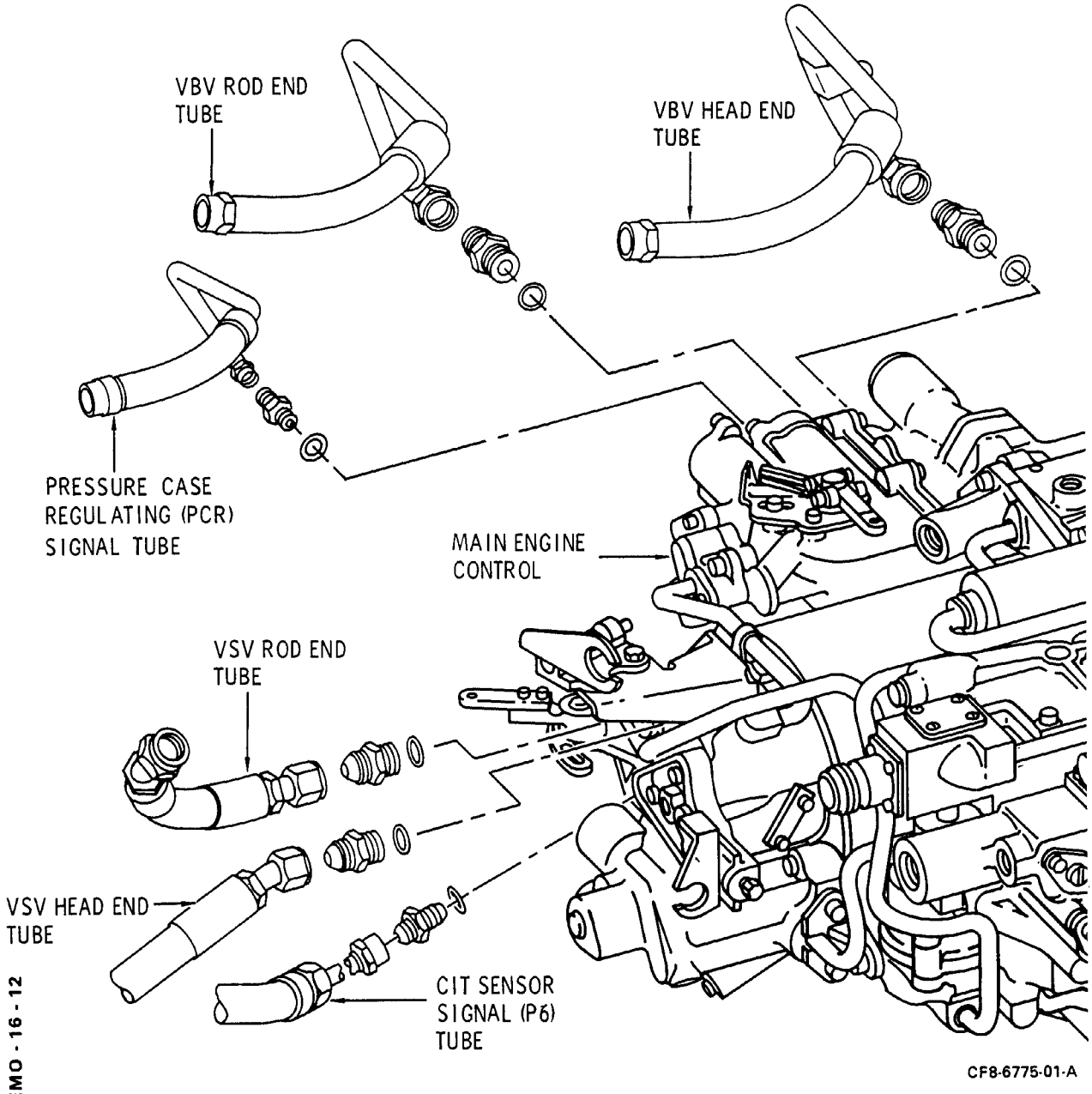
(1)Remove protective caps and plugs from all MEC openings.
(2)Apply a thin layer of oil (C02-058) to the preformed packings, B-nuts and shoulder of ferrule. Examine the gaskets for cuts or gouges in sealing surfaces prior to installation.
(3)Assemble preformed packings on unions and install into the following MEC ports. (Ref. Fig. 401, 402, 403)
(a)VBV rod-end port. TORQUE to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
(b)VBV head-end port. TORQUE to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).
(c)CDP signal port. TORQUE to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
NOTE : The short, machined-off end of the fitting must be assembled into the CDP signal port of MEC.
(d)VSV rod-end port. TORQUE to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).
(e)VSV head-end port. TORQUE to between 360 and 400 lbf.in. (4.07 and 4.52 m.daN).
(f)P7 signal port. TORQUE to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
(g)P8 signal port. TORQUE to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
(h)Overboard drain port. TORQUE to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
(i)T2 sensor return (PB) port. TORQUE to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).
(j)CIT sensor signal (P6) port. TORQUE to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
(k)Turbine clearance signal (Tc) port. TORQUE to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
(l)PCR port. TORQUE to between 135 and 150 lbf.in. (1.52 and 1.69 m.daN).



Main Engine Control Removal/Installation
Figure 401



Main Engine Control Removal/Installation
Figure 402


VBV ROD END TUBE
VBV HEAD END TUBE
PRESSURE CASE REGULATING (PCR) SIGNAL TUBE
MAIN ENGINE CONTROL
VSV ROD END TUBE
VSV HEAD END TUBE
CIT SENSOR SIGNAL (P6) TUBE
CF8-6775-01-A
BM5 73 21 01 4 LEMO - 16 - 12
DM5

Main Engine Control Removal/Installation
Figure 403

(m)N1 sensor return (PBR) port. TORQUE to between 270 and 300 lbf.in. (3.05 and 3.40 m.daN).
(n)CBP port. TORQUE to between 135 and 150 lbf.in. (1.52 and 1.69 m.daN).
(4)Attach MEC to install/remove fixture 2C14797 or 2C14852.
(5)Install new or serviceable gasket on MEC mounting flange.
(6)Install new preformed packing onto MEC spline.
WARNING : ASSEMBLY WEIGHT IS APPROXIMATELY 72.5 LBS. (34.2 KG).
CAUTION : ALIGN CONTROL CAREFULLY TO PREVENT SPLINE DAMAGE. TURN SPLINE ONLY BY HAND.
CAUTION : DO NOT APPLY AN AXIAL FORCE IN EXCESS OF 25 LBS. (11.3 KG) TO MEC THROTTLE SHAFT DURING INSTALLATION.
CAUTION : TO PREVENT DAMAGE TO THE MEC CARBON FACE SEAL DURING INSTALLATION THE ACCESSORY GEARBOX SHOULD BE SLOWLY ROTATED DURING MEC INSTALLATION FOR SPLINE ALIGNMENT.
CAUTION : WHEN INSTALLING THE MEC ON GEARBOX ADAPTER PAD, USE CARE TO PREVENT MEC VSV HEAD AND ROD END NIPPLES FROM BEING DAMAGED BY CONTACT WITH BRACKET.
(7)Remove accessory gearbox borescope turning pad cover plate.
(8)Lower jack on install/remove fixture to lowest position and transport MEC to its mounting position under the right side of the accessory drive module.
CAUTION : MAKE SURE THAT ALL WASHERS ARE REMOVED FROM MEC MOUNTING STUDS TO PREVENT FUEL LEAKAGE.
(9)Place the plastic shims on the AGB stud and on the MEC stud. (Ref. Fig. 404, 405)
(10)Raise MEC into mounting position using hydraulic foot pump and adjust for proper attitude using fixture tilt adjustment.
CAUTION : YOU MUST KEEP PRESSURE AGAINST THE MEC UNTIL THE MOUNTING NUTS ARE TIGHTENED. DAMAGE TO THE MEC DRIVESHAFT CAN OCCUR IF YOU DO NOT KEEP PRESSURE AGAINST THE MEC DURING THE INSTALLATION. USE AN AXIAL FORCE THAT IS LESS THAN 25 LBS (11.3 KG) AGAINST THE MEC.
(11)Attach the MEC to the AGB pad with nuts and washers (Ref. Fig. 405) (Section A.A).
NOTE : The final torque will be done with a torque wrench and torque adapter after the MEC is aligned.
(12)Remove the plastic shims.
CAUTION : CAREFULLY ALIGN THE MEC TO PREVENT DAMAGE TO THE MEC SPLINE OR THE PACKING.
(13)Insert a torque handle with a 0.5 in. (12.7 mm) square drive into the turn pad to slowly turn the AGB gears.
(14)While you turn the AGB drive gears, push the MEC into position until the splines on the MEC driveshaft align with the AGB gear shaft splines.
(a)Continue to hold the MEC while you seat the nut on the stud at the 10 o'clock position (forward-locking-aft).
CAUTION : MAKE SURE YOU TIGHTEN THE NUTS CORRECTLY. IF THE NUTS ARE NOT TIGHTENED TO THE CORRECT TORQUE VALUE, FUEL LEAKAGE CAN OCCUR.
(15)Use the torque wrench, torque adapter and extension 12-18 in. (304.8-457.2 mm), to tighten the nuts to the final torque value.
(a)Tighten from the forward side of the MEC, and keep the torque adapter at a 90 degree angle to the torque wrench.

NOTE : This is to eliminate the need to apply a correction factor to the torque adapter.

(b)TORQUE the nuts to between 175 and 200 lbf.in. (1.98 and 2.26 m.daN) (Ref. Fig. 406).

(16)Release hold down strap and remove install/remove fixture from the MEC.

(17)Install preformed packing on cover plate and install cover.

(18)Connect the following to the MEC (recommended in order listed) : (Ref. Fig. 401, 402, 403).

Pre SB GE 73-231

WARNING : YOU MUST INSTALL NEW FUEL TUBES. REFER TO GE ALERT SERVICE BULLETIN FOR THE NEW FUEL TUBE PART NUMBERS. IF THE FUEL TUBES ARE NOT REPLACED, IT IS POSSIBLE TO HAVE HIGH PRESSURE FUEL LEAKS. ENGINE FIRE OR DAMAGE CAN OCCUR.

End Pre SB GE 73-231

(a)Not applicable.

(b)Position gasket and fuel outlet manifold over manifold flange and install washers and bolts. TORQUE bolts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).

(c)Secure the VBV feedback cable in MEC bracket as follows : (Ref. Fig. 401, 402, 403)

1 Remove the support tube assembly from the cable.

2 Carefully insert the cable into MEC bracket and secure by reinstalling the support tube assembly. TORQUE to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN) and wirelock.

3 Connect the VBV cable rod end to MEC lever arm with bolt, washer, and nut. TORQUE to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN). Secure with cotter pin.

(d)Sensor signal (P7). TORQUE signal tube B-nut to between 270 and 300 lbf.in. (3.05 and 3.40 m.daN).

(e)Return tube (PB). TORQUE return tube B-nut to between 450 and 550 lbf.in. (5.08 and 6.21 m.daN).

(f)P6 signal tube. TORQUE B-nut to between 270 and 300 lbf.in. (3.05 and 3.40 m.daN).

(g)Turbine clearance (Tc). TORQUE B-nut to between 270 and 300 lbf.in. (3.05 and 3.40 m.daN).

(h)P8 signal tube. TORQUE B-nut to between 270 and 300 lbf.in. (3.05 and 3.40 m.daN).

(i)PBR return tube. TORQUE B-nut to between 450 and 550 lbf.in. (5.08 and 6.21 m.daN).

Pre SB GE 73-159

(j)PCR tube. TORQUE B-nut to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).

End Pre SB GE 73-159

Post SB GE 73-159

(j)PCR tube. TORQUE B-nut to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN).

End Post SB GE 73-159

(k)Overboard drain tube. TORQUE B-nut to between 270 and 300 lbf.in. (3.05 and 3.40 m.daN).

(l)Install CDP tube. TORQUE both B-nuts to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN) (Ref. Fig. 407).

CAUTION : CABLE INNER MEMBER MUST BE FULLY RETRACTED(IN DIRECTION AWAY FROM MEC) BEFORE REMOVING SUPPORT TUBE ASSEMBLY TO AVOID DAMAGE TO EXPOSED INNER MEMBER.

(m)Secure the VSV feedback cable in MEC bracket as follows : (Ref. Fig. 401, 402, 403)

1 Remove the support tube assembly from the cable.

2 Carefully insert the cable into MEC bracket and secure by reinstalling the support tube assembly. TORQUE to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN) and wirelock.

3 Connect the VSV cable rod end to MEC lever arm with bolt, washer, and nut. TORQUE nut to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN). Secure with cotter pin.

(n)Connect shutoff/IRS electrical connector and hand tighten.

(o)Connect PMC TORQUE motor/reducer electrical connector and hand tighten.

(p)Install throttle control box (Ref. 76-11-62, P. Block 401).

(q)Static rig VSV and VBV feedback systems and check operation. (Ref. 73-21-01, P. Block 501).

(r)VBV rod-end tube. TORQUE B-nut to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).

(s)VBV head-end tube. TORQUE B-nut to between 450 and 550 lbf.in. (5.08 and 6.21 m.daN).

Pre SB GE 72-556

(t)VSV head-end tube. TORQUE B-nut to between 650 and 770 lbf.in. (7.28 and 8.62 m.daN).

(u)VSV rod-end tube. TORQUE B-nut to between 450 and 550 lbf.in. (5.08 and 6.21 m.daN).

End Pre SB GE 72-556

Post SB GE 72-556

(t)VSV head-end tube. TORQUE B-nut to between 450 and 550 lbf.in. (5.08 and 6.21 m.daN).

(u)VSV rod-end tube. TORQUE B-nut to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).

End Post SB GE 72-556

(v)Install CBP tube. TORQUE both B-nuts to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).

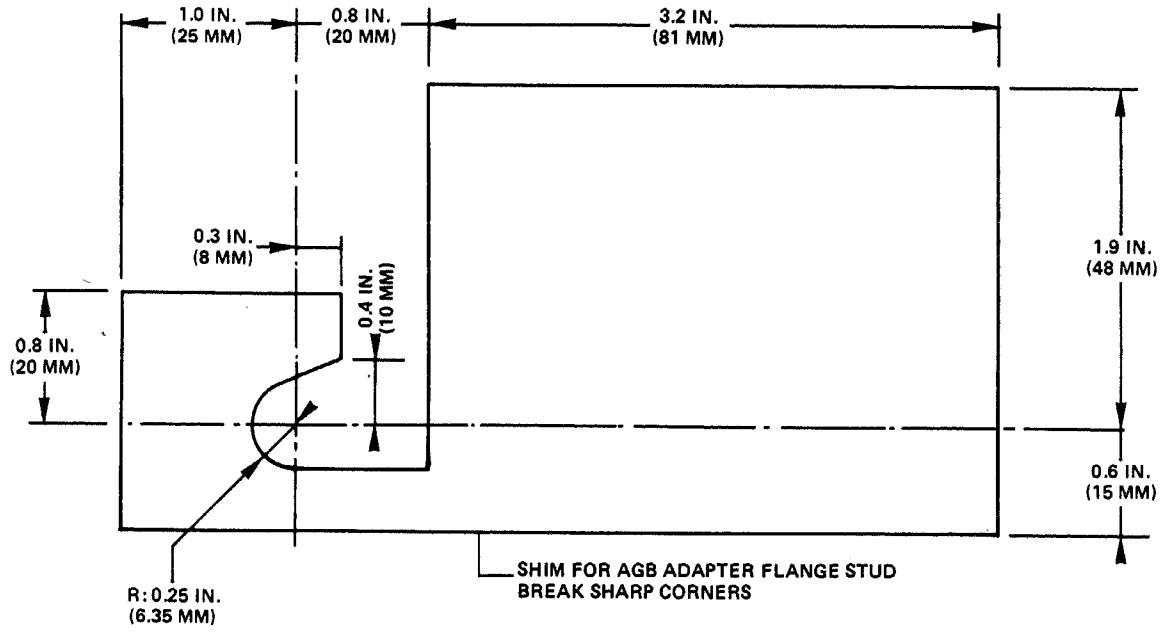
D. Close-Up and Test

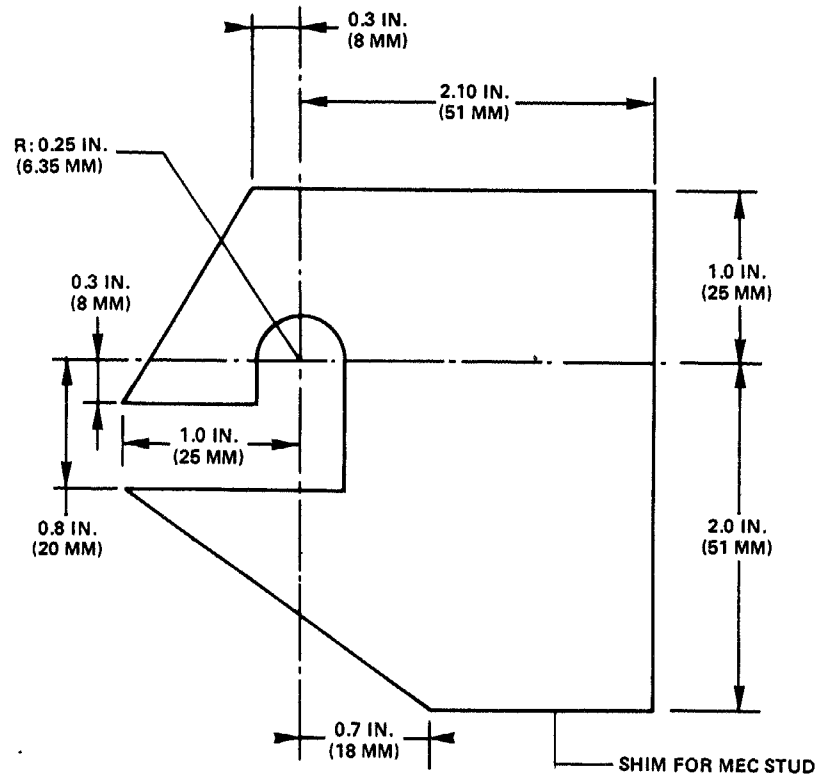
(1)Remove the safety clip and tag and close circuit breaker 4KS.

(2)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(3)Remove the safety clips and tags and close circuit breakers close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

(4)Perform the test that follows, "Type of Testing after Engine Component Replacement" (Ref. 71-00-00, P. Block 501).

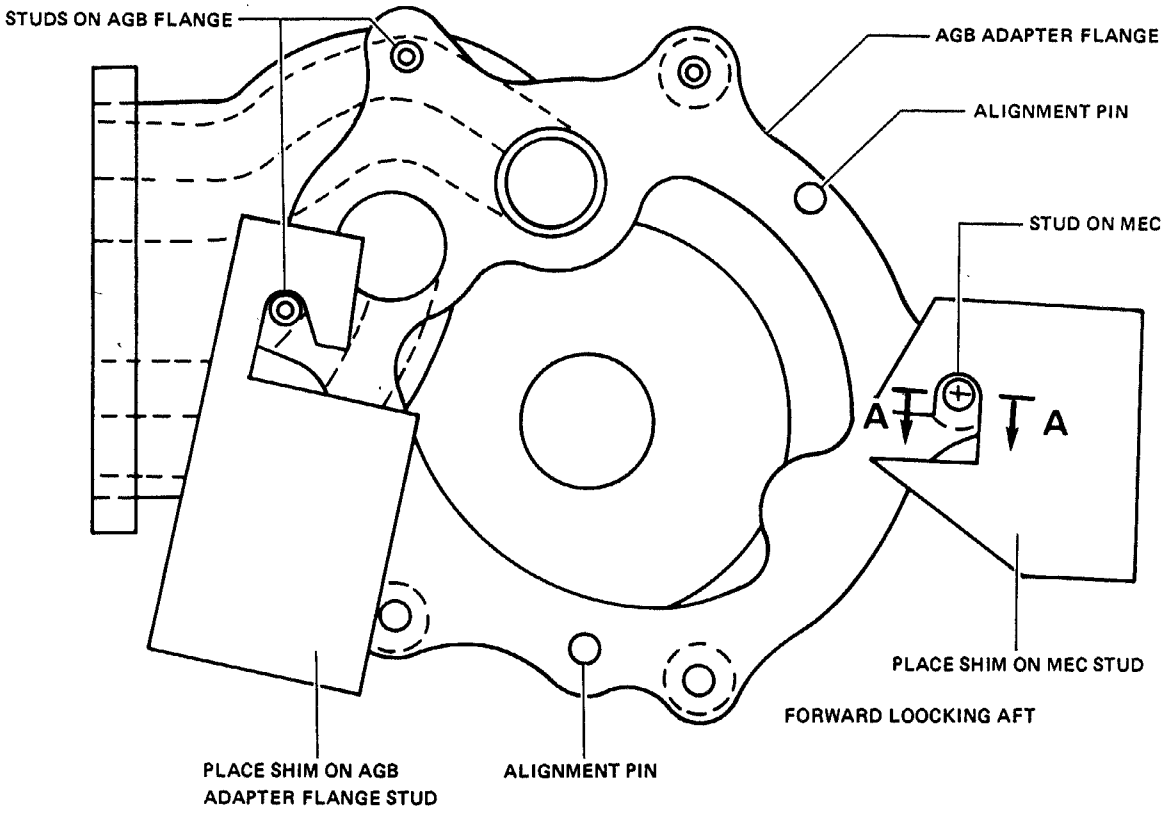


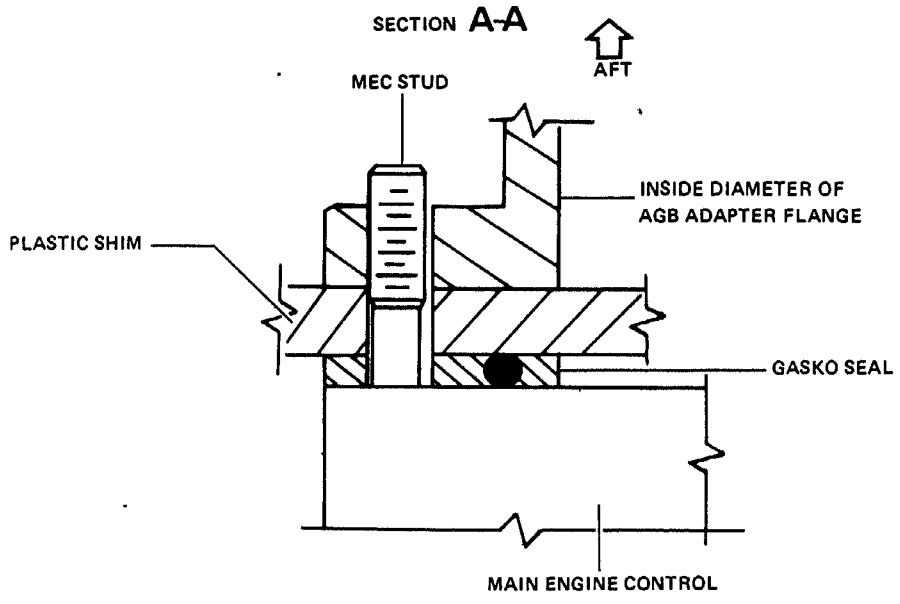


MATERIAL: LEXAN OR PLEXIGLASS OR EQUIVALENT PLASTIC
0.25 IN. (6.35 MM) THICK.

BM5 73 21 01 4 LGMO - 25 - 20
DM5

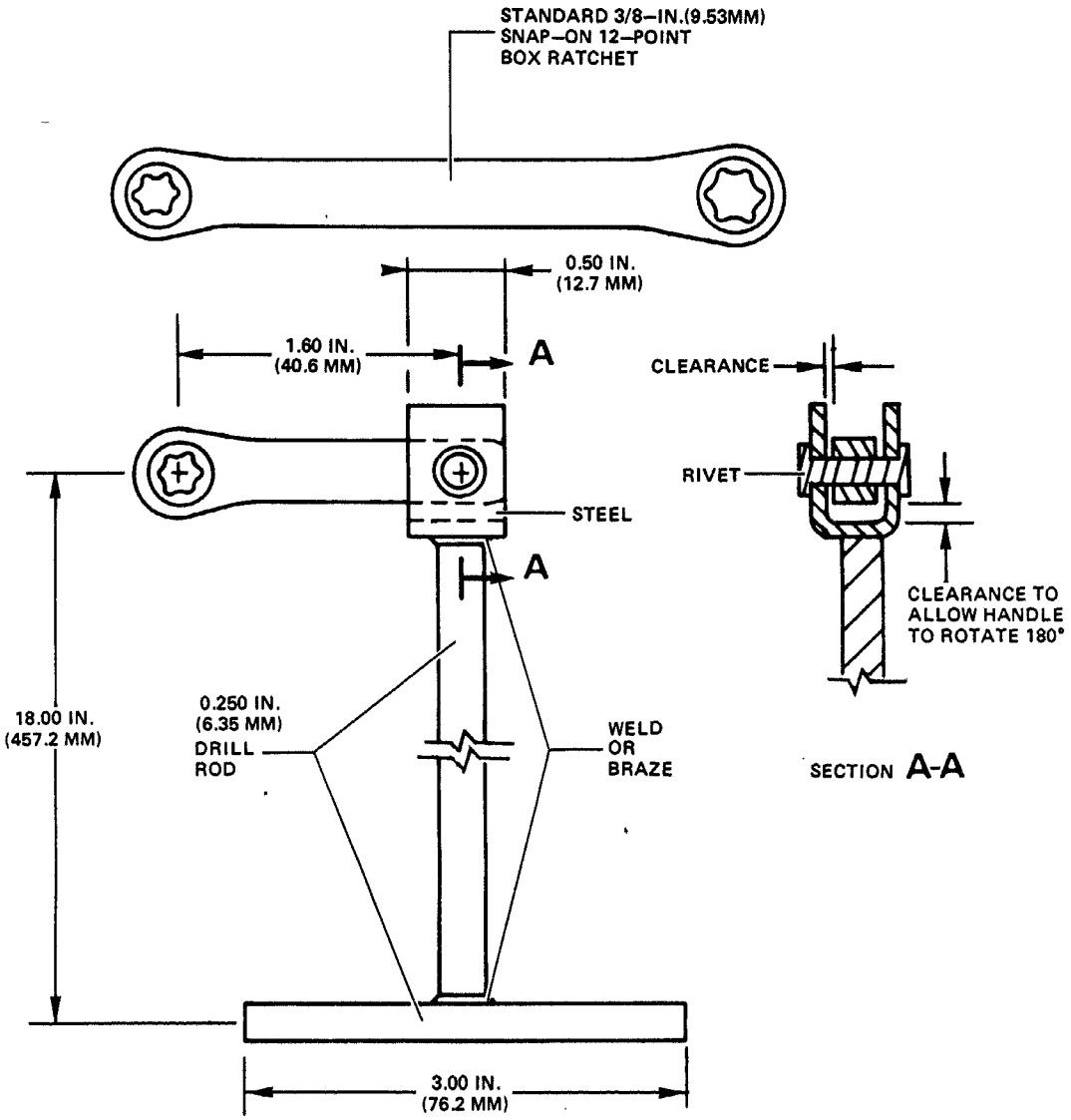
Plastic MEC Shims
Figure 404





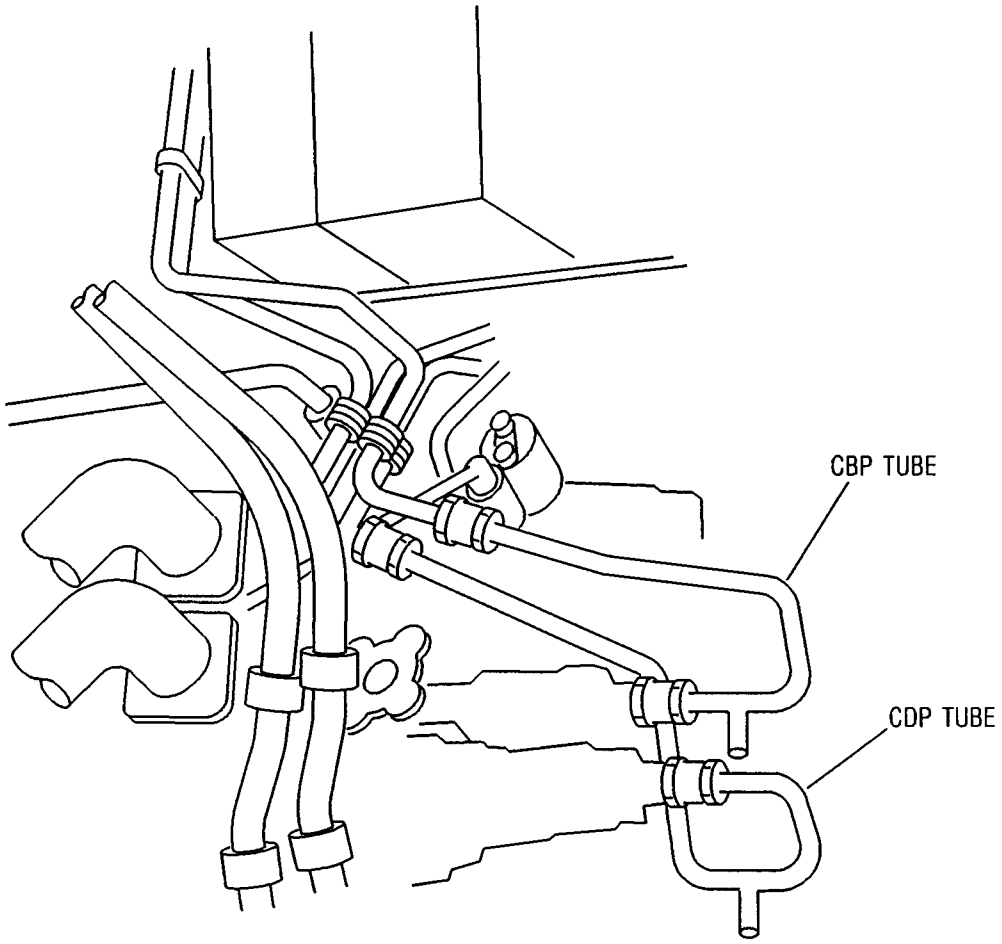
BM5 73 21 01 4 LJMO - 25 - 20
DM5

Accessory Gearbox Adapter Flange (Positioning the Plastic Shims)
Figure 405



BM5 73 21 01 4 LMMO · 25 · 20
DM5

Locally - Manufactured MEC Wrench
Figure 406



1109611-00-A

BM5 73 21 01 4 LPMO - 00

CDP and CBP Tube - Removal/Installation
Figure 407

1. General

CAUTION : DO NOT ATTEMPT UNAUTHORIZED ADJUSTMENTS. ENGINE DAMAGE CAN OCCUR. The adjustments and tests given in this procedure are the only adjustments and tests authorized at the on-line maintenance level.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B. 2C6395	Actuator, Hydraulic - VSV/VBV
C.	Pull Scale, 0-20 lbf. (0-8.9 daN)
D. Material No.C01-006	Adhesives, Plastics, Sealants (Ref. 70-00-00)
E. Material No.C02-021	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
F. Material No.C04-002	Cleaning Compounds and Solvents (Ref. 70-00-00)
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant
- 71-13-00, P. Block 301	Cowl Doors
- 72-00-00, P. Block 501	Engine-General

3. Procedure

A. Job Set-Up

(1)Open, safety and tag the circuit breakers for the appropriate engine and open fan cowl and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Rigging of the VSV and VBV Feedback System

NOTE : The following procedure allows VSV and VBV rigging to be performed simultaneously or separately by selecting applicable steps.

PROCEDURE	STEP(S)
VSV Cable Movement Check	3.B. (1)
VSV Cable Movement Check	3.B. (2)
VSV Cable Replacement Rig	3.B. (1), (3) and (4)
VSV Cable Replacement Rig	3.B. (2), (5) and (6)
MEC Replacement Rig	3.B. (3) through (6)
VSV Static Rig	3.B. (3) and (4)
VBV Static Rig	3.B. (5) and (6)

(1)Do a pull check to examine the movement of the VSV feedback cable as follows :

(a)Examine the VSV feedback cable installation to make certain that there is no distortion, sharp bends, or binding.

(b)Remove the cotter pin, nut, bolt, and two washers to disconnect the VSV

feedback cable from the compressor case bellcrank.

(c)Remove the cotter pin, nut, bolt, and two washers to disconnect the VSV feedback cable from the MEC lever arm.

(d)Make certain that the VSV feedback cable inner member is fully retracted into the outer conduit at the MEC lever arm or compressor case bellcrank. Attach a pull scale to the rod-end bearing at one of the two ends.

(e)Apply a constant force at a slow rate and in a straight line. Do not change the direction of the pull more than 4 degrees of the outer conduit centerline. If the force to pull the cable is more than 10 lbf. (4.4 daN), replace the cable.

NOTE : Do not lubricate or clamp anything to any part of the VSV feedback cable.

R (f)Connect the VSV feedback cable to the compressor case bellcrank.

R (g)Install the nut, bolt, and two washers to connect the VSV feedback cable to the MEC lever arm. TORQUE the nut to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
Safety the assembly with the cotter pin.

(2)Do a pull check to examine the movement of the VBV feedback cable as follows :

(a)Remove the four screws and the inner flowpath liner segment from between the fan frame struts No. 10 and No. 11.

(b)Examine the installation of the VBV feedback cable to make certain that there is no distortion, sharp bends, or binding.

(c)Remove the nut, bolt, and two washers to disconnect the VBV feedback cable from the fan frame actuator clevis.

(d)To disconnect the VBV feedback cable from the MEC lever arm, remove the cotter pin, nut, bolt, and two washers.

(e)Make certain that the VBV feedback cable inner member is fully retracted into the outer conduit at the MEC end. Attach a pull scale to the rod-end bearing at the MEC.

(f)Apply a constant force at a slow rate and in a straight line and do a pull check on the cable at the MEC.
If the force to pull the cable is more than 12 lbf (5.3 daN), replace the cable.

NOTE : Do not lubricate any part of the VBV feedback cable.

(g)Install the nut, bolt, and two washers to connect the VBV feedback cable to the fan frame actuator clevis. TORQUE to between 50 and 85 lbf.in. (0.56 and 0.96 m.daN).

(h)Install the nut, bolt, and two washers to connect the VBV feedback cable to the MEC lever arm. TORQUE to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN). Safety the assembly with the cotter pin.

(i)Use the four screws to install the inner flowpath liner segment between fan frame struts No. 10 and No. 11.

(j)TORQUE the bolts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).

(k)Fill the axial gap between the aft inner liner segment panel with Material No.C01-006.

(3)Perform on overtravel check on the VSV feedback cable.

NOTE : There are two procedures for doing an overtravel check on the VSV feedback cable : using a hydraulic actuator tool, 2C6395G05 and

the engine motoring.

(a)Perform an overtravel check on the VSV feedback cable with the hydraulic actuation tool, 2C6395G05, as follows :

1 Loosen the lockscrew bolt on the MEC VSV trimmer bracket and adjust the bracket to the mid travel position.

2 Remove the cotter pin, bolt, nut and two washers and disconnect the VSV feedback cable from the MEC lever arm.

3 Disconnect the VSV rod and head-end hoses at the MEC. Cap the MEC fittings (Ref. Fig. 501).

CAUTION : DO NOT EXCEED 300 PSIG (20.68 BARS) SUPPLY PRESSURE.

4 Connect hydraulic actuator, 2C6395G05, to the VSV actuator rod and head-end hoses. Using hydraulic medium (C02-021 or C04-002), actuate the compressor stator vanes open by applying and maintaining 200-300 psig (13.78-20.68 bars) to the VSV actuator head-end.

NOTE : If the hydraulic actuator (2C6395G03) is not locally available, compressed nitrogen may be used to apply and maintain pressure.

5 Push the MEC VSV feedback lever to the open position and check for a gap between the MEC feedback lever bolt hole and the feedback cable rod end bolt hole (Ref. Fig. 502). If there is no gap, adjust the cable rod end. Check the witness hole to make sure a 0.055 in. (1.40 mm) wire will not pass through the witness hole of the rod end. If it does, a full, cable travel check and adjustment of both rod ends will be necessary. Refer to 3.B.(1) to disconnect and re-connect the upper end of the cable.

6 Close the variable stator vanes by applying and maintaining 200-300 psig (13.78-20.68 bars) to VSV actuator rod-end.

7 With the MEC VSV feedback lever against the closed stop (lever toward trimmer bracket) check for overtravel between the MEC feedback lever bolt hole and the feedback cable rod end holt hole (Ref. Fig. 502). If there is no overtravel, adjust the cable rod end. Check the witness hole to make sure a 0.055 in. (1.40 mm) wire will not pass through the witness hole of the rod end. If it does, a full, cable travel check and adjustment of both rod ends will be necessary. Refer to 3.B.(1) to disconnect and re-connect the upper end of the cable.

8 Connect the VSV feedback cable to the top side of the MEC feedback lever with a bolt, two washers, and nut. TORQUE to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN). Secure with a cotter pin.

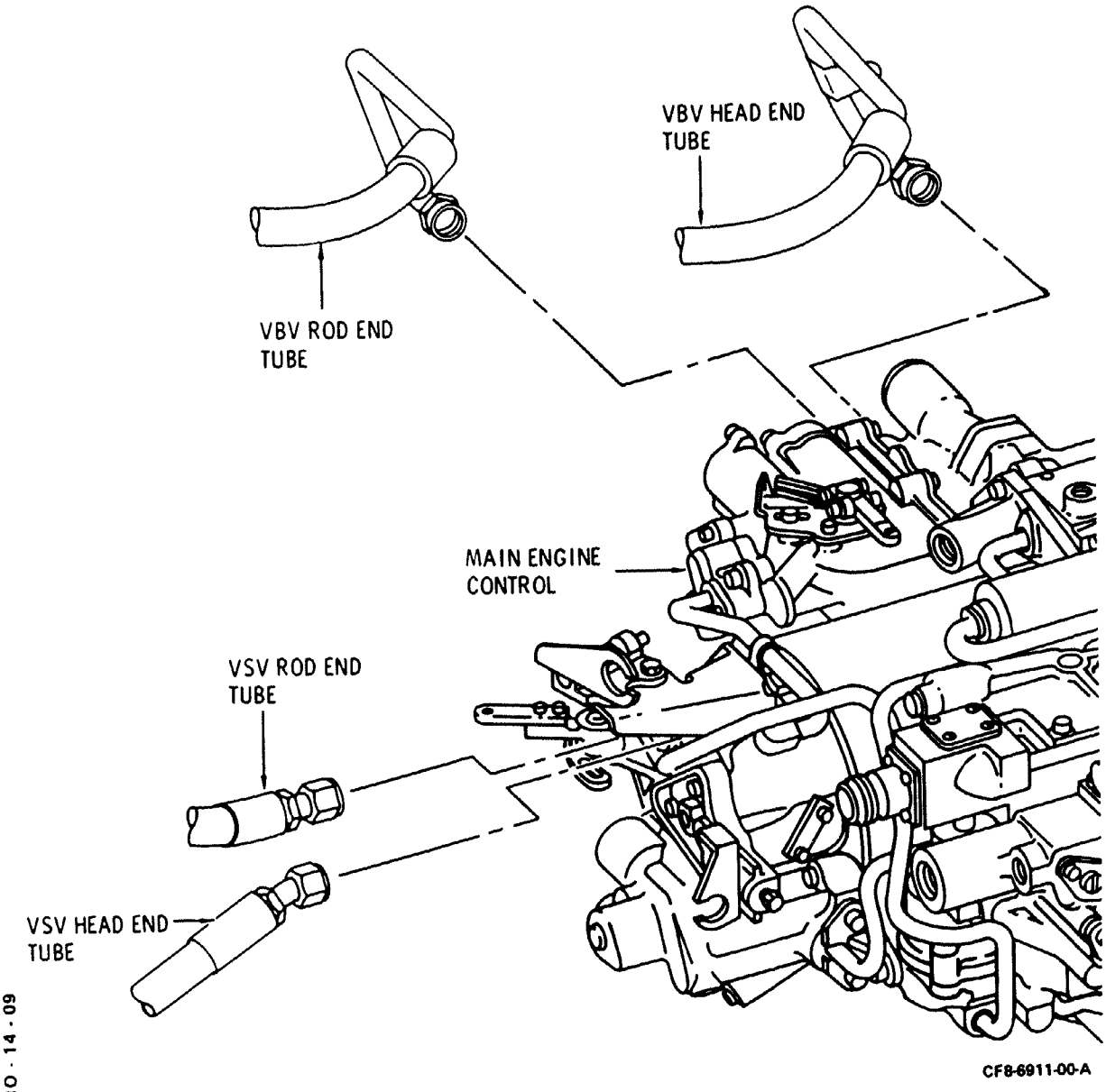
(b)Alternate procedure. Perform an overtravel check on the VSV feedback cable using the engine motoring method as follows :

1 Loosen the lockscrew on the MEC VSV trimmer bracket and adjust the bracket to the mid-travel position.

2 Remove the cotter pin, bolt, nut, and two washers and disconnect the VSV feedback cable from the MEC lever arm.

3 Open the variable stator vane as follows :

- Move the MEC VSV feedback lever toward the MEC trimmer bracket (this signals the MEC that the stator vanes are too far closed) and restrain (Ref. Fig. 503).
- Motor the engine to drive the variable stator vanes open. Do not release the VSV feedback lever until the engine stops rotating.



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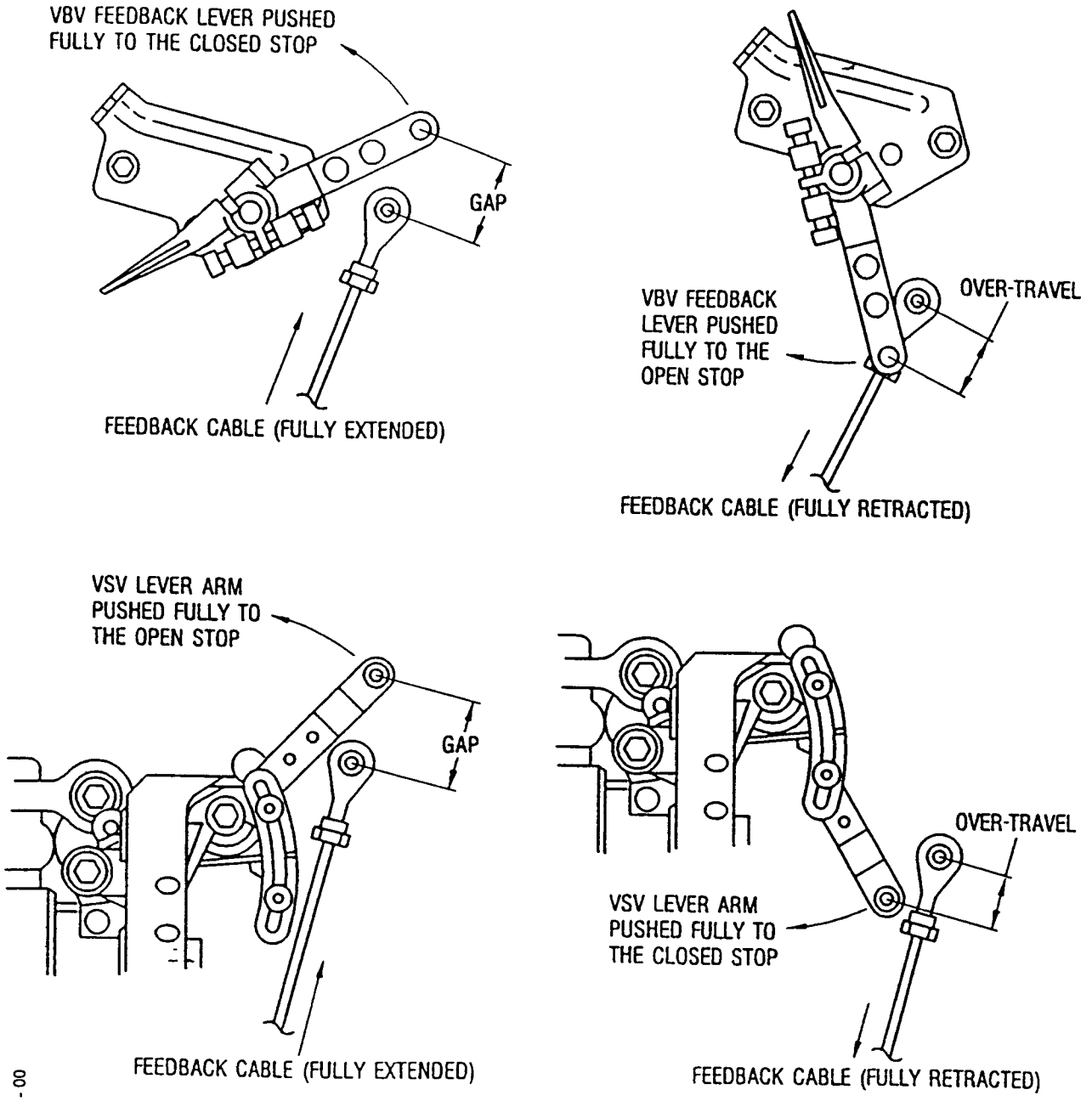
Location of VSV/VBV Fuel Ports
Figure 501


VBV FEEDBACK LEVER PUSHED FULLY TO THE CLOSED STOP
GAP
FEEDBACK CABLE (FULLY EXTENDED)
VBV FEEDBACK LEVER PUSHED FULLY TO THE OPEN STOP
OVER-TRAVEL
FEEDBACK CABLE (FULLY RETRACTED)
VSV LEVER ARM PUSHED FULLY TO THE OPEN STOP
GAP
FEEDBACK CABLE (FULLY EXTENDED)
OVER-TRAVEL
VSV LEVER ARM PUSHED FULLY TO THE CLOSED STOP
FEEDBACK CABLE (FULLY RETRACTED)
1108195-00-A

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VSV and VBV Feedback Control Adjustments
Figure 502

4 Push the MEC VSV feedback lever to the open position and check for a gap between the MEC feedback lever bolt hole and the feedback cable rod end bolt hole (Ref. Fig. 502). If there is no gap, adjust the cable rod end. Check the witness hole to make sure a 0.055 in. (1.40 mm) wire will not pass through the witness hole of the rod end. If it does, a full, cable travel check and adjustment of both rod ends will be necessary. Refer to 3.B.(1) to disconnect and re-connect the upper end of the cable.

5 Close the VSV as follows :
- Move the MEC VSV feedback lever away from the MEC trimmer bracket (this signals the MEC that the stator vanes are too far open) and restrain (Ref. Fig. 503).
- Motor the engine to drive the variable stator vanes closed. Do not release the VSV feedback lever until the engine stops rotating.

6 With the MEC VSV feedback lever against the closed stop (lever toward trimmer bracket), check for overtravel between the MEC feedback lever bolt hole and the feedback cable rod end bolt hole (Ref. Fig. 502). If there is no overtravel, adjust the cable rod end. Check the witness hole to make sure a 0.055 in. (1.40 mm) wire will not pass through the witness hole of the rod end. If it does, a full, cable travel check and adjustment of both rod ends will be necessary. Refer to 3.B.(1) to disconnect and re-connect the upper end of the cable.

7 Connect the VSV feedback cable to the top side of the MEC feedback lever with a bolt, two washers, and nut. TORQUE to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN). Secure with a cotter pin.

(4)Static rig the VSV feedback system as follows :

NOTE : In the event a new MEC is installed, make certain that the adjustable rig plate notch is aligned with the notch in the bracket assembly.

(a)Put the VSV in the OPEN position.

(b)Apply a 20 ± 5 lbf (8.9 ± 2.2 daN) force to the VSV linkage (Ref. Fig. 504).

(c)Make certain that the alignment rig indicator is centered in the rig notch.

(d)Adjust the MEC VSV trimmer bracket by the adjust screw until the rig indicator is aligned with the stationary rig notch.

(e)TORQUE MEC trimmer bracket lockscrew to between 32 and 35 lbf.in. (0.36 and 0.39 m.daN).

(f)If the pressurizing unit, 2C6395G05 was used perform the following :

1 Bleed off all pressure and disconnect the hydraulic actuator from the VSV rod and head-end hoses.

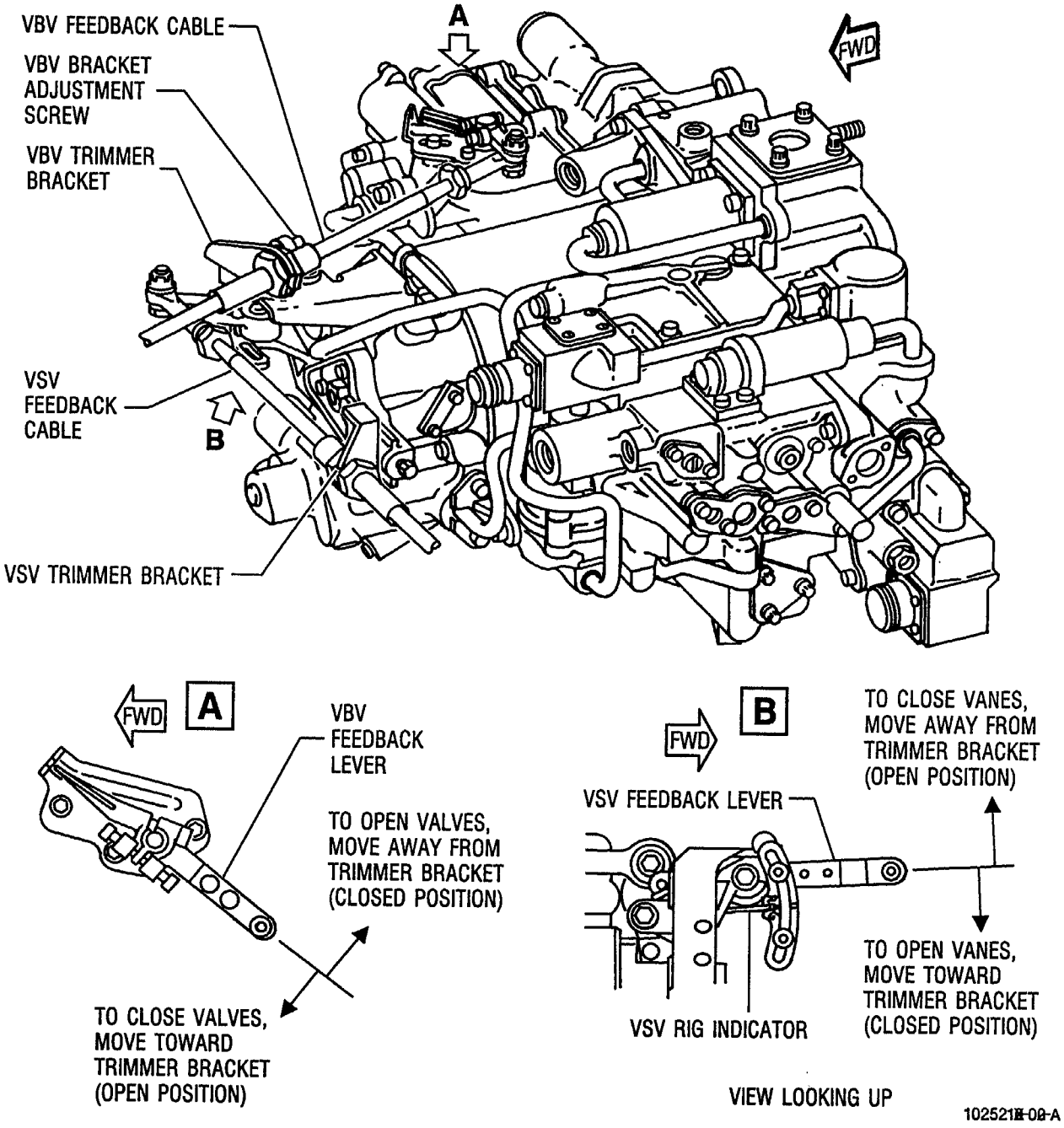
2 Connect the VSV rod and head-end hoses to the fittings in the MEC. TORQUE the VSV rod-end hose to between 450 and 550 lbf.in. (5.1 and 6.21 m.daN). TORQUE the VSV head-end hose to between 650 and 770 lbf.in. (7.34 and 8.70 m.daN).

(5)Perform an overtravel check on the VBV feedback cable.

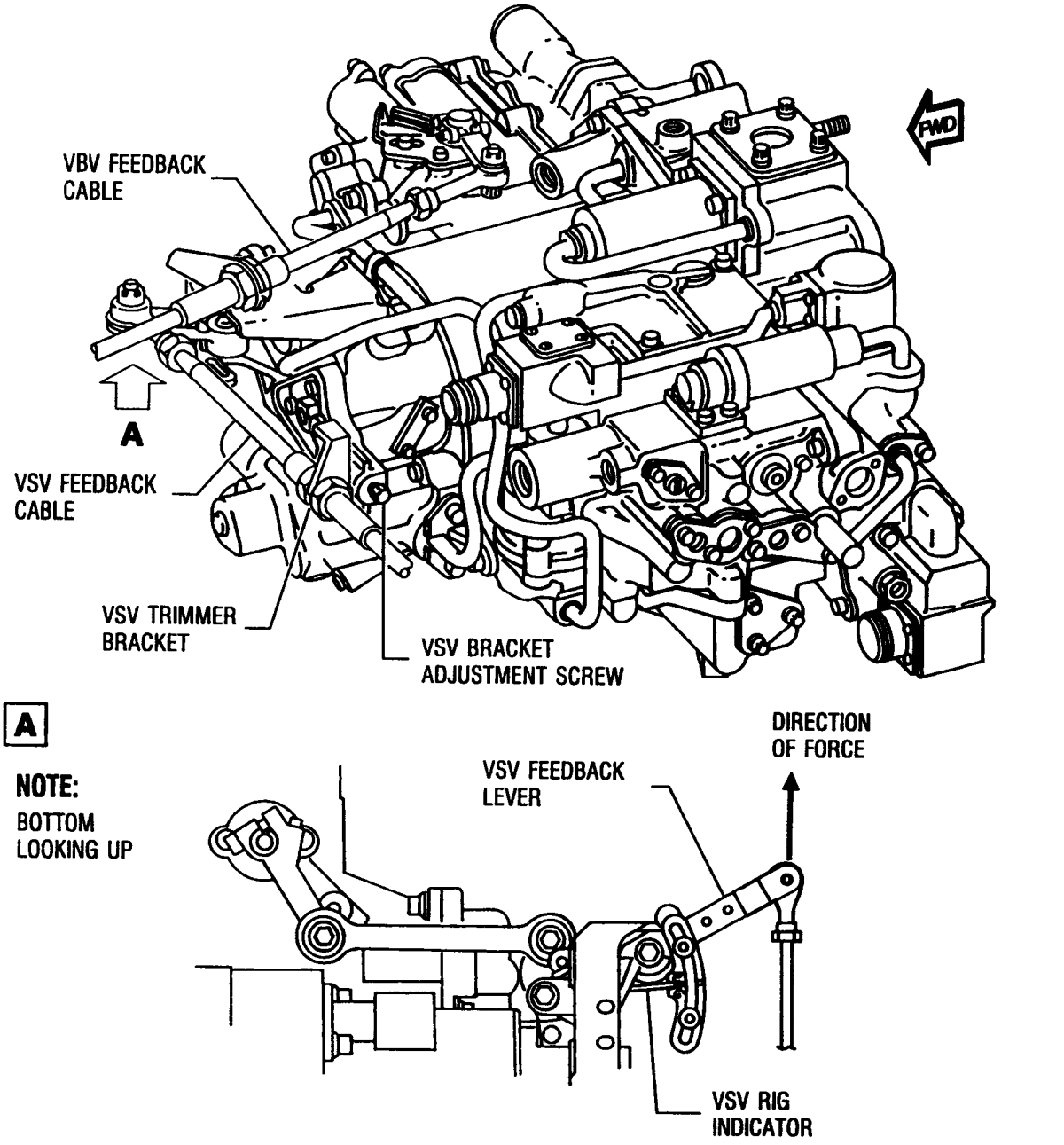
(a)Perform an overtravel check on the VBV feedback cable with the hydraulic actuation tool, 2C6395G05 as follows :

NOTE : If 2C6395G05 tool is not available, refer to step (5) (b) alternate engine motoring procedure.

1 Remove the cotter pin, bolt, nut, and two washers and disconnect the



Positioning of the VSV/VBV Feedback Lever
Figure 503



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Static Rigging of the VSV Feedback System
Figure 504

VBV feedback cable from the MEC lever arm.

2 Disconnect the VBV rod and head-end hoses at the MEC (Ref. Fig. 501).
CAUTION : DO NOT EXCEED 300 PSIG (20.68 BARS) SUPPLY PRESSURE.

3 Connect hydraulic actuator, 2C6395G05, to the VBV actuator rod and head-end hoses. Using hydraulic medium (C02-021 or C04-002), actuate the variable bypass valves closed by applying and maintaining 200-300 psig (13.78-20.68 bars) to VBV actuator rod-end.

4 Loosen the lockscrew on the MEC VBV trimmer bracket and adjust the bracket to the mid-travel position.

5 With the MEC VBV feedback lever against the closed stop, check for a gap between the MEC feedback lever bolt hole and the feedback cable rod end bolt hole (Ref. Fig. 502). If there is no gap, adjust the cable rod end. Check the witness hole to make sure a 0.055 in. (1.40 mm) wire will not pass through the witness hole of the rod end. If it does, a full, cable travel check and adjustment of both rod ends will be necessary. Refer to 3.B.(2) to disconnect and re-connect the upper end of the cable.

6 Open the variable bypass valves by applying and maintaining 200-300 psig (13.78-20.68 bars) to the VBV actuator head-end.

7 Push the MEC VBV feedback lever to the open position and check for overtravel between the MEC feedback lever bolt hole and the feedback cable rod end bolt hole (Ref. Fig. 502). If there is no overtravel, adjust the cable rod end.
Check the witness hole to make sure a 0.055 in. (1.40 mm) wire will not pass through the witness hole of the rod end. If it does, a full, cable travel check and adjustment of both rod ends will be necessary. Refer to 3.B.(2) to disconnect and re-connect the upper end of the cable.

8 Connect the VBV feedback cable to the MEC feedback lever arm (bottom side) with a bolt, washers, and nut. TORQUE to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN). Secure with cotter pin.

(b) Alternate procedure. Perform an overtravel check on the VBV feedback cable using engine motoring method as follows :

1 Close the variable bypass valve as follows :
- remove the cotter pin, bolt, nut, and two washers and disconnect the VBV feedback cable from the MEC lever arm.
- Move the MEC VBV feedback lever toward the MEC trimmer bracket (this signals the MEC that the bypass valves are open) and restrain (Ref. Fig. 503).
- Motor the engine to drive the variable bypass valves closed. Do not release the VBV feedback lever until the engine stops rotating.

2 Loosen the lockscrew on the MEC VBV trimmer bracket and adjust the bracket to the mid-travel position.

3 With the MEC VBV feedback lever against the closed stop, check for a gap between the MEC feedback lever bolt hole and the feedback cable rod end bolt hole (Ref. Fig. 502). If there is no gap, adjust the cable rod end. Check the witness hole to make sure a 0.055 in. (1.40 mm) wire will not pass through the witness hole of the rod end. If it does, a full, cable travel check and adjustment of both rod ends will be necessary. Refer to 3.B.(2) to disconnect and re-connect the upper end of the cable.

4 Open the variable bypass valves as follows :
- Move the MEC VBV feedback lever away from the MEC trimmer bracket (this signals the MEC that the bypass valves are closed) and restrain.
- Motor the engine to drive the variable bypass valves open. Do not release the VBV feedback lever until the engine stops rotating.

5 Push the MEC VBV feedback lever to the open position and check for overtravel between the MEC feedback lever bolt hole and the feedback cable rod end bolt hole (Ref. Fig. 502). If there is no overtravel, adjust the cable rod end.
Check the witness hole to make sure a 0.055 in. (1.40 mm) wire will not pass through the witness hole of the rod end. If it does, a full, cable travel check and adjustment of both rod ends will be necessary. Refer to 3.B.(2) to disconnect and re-connect the upper end of the cable.

6 Connect the VBV feedback to the MEC feedback lever arm (bottom side) with a bolt, washer, and nut. TORQUE the nut to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN) and install a cotter pin.

(6)Static rig the VBV feedback system as follows :
(a)Put the VBV in the CLOSED position.
(b)Ensure that the alignment rig indicator is centered in the rig notch.
(c)Apply a 20 ± 5 lbf. (8.9 ± 2.2 daN) force to the MEC VBV feedback lever as shown (Ref. Fig. 505).
(d)Adjust the MEC VBV trimmer bracket by the adjust screw until the rig indicator is aligned with the stationary rig notch.
(e)TORQUE MEC trimmer bracket lockscrew to between 32 and 35 lbf.in. (0.36 and 0.39 m.daN).
(f)If the pressurizing unit, 2C6395G05 was used, perform the following :
1 Bleed off all pressure and disconnect the hydraulic actuator from the VBV rod and head-end hoses.
2 Connect the VBV rod and head-end hoses to the MEC fittings. TORQUE the VBV rod-end hose to between 270 and 300 lbf.in. (3.05 and 3.4 m.daN).
(g)If necessary, install the fan frame inner flowpath liner segment panel between fan frame struts No. 10 and 11. TORQUE bolts to between 55 and 70 lbf.in.
(0.62 and 0.78 m.daN).
(h)Fill the axial gaps between the aft inner liner segment panel with black silicone rubber compound (C01-006).

C. Specific Gravity Adjustment (Ref. Fig. 506)
CAUTION : THE SPECIFIC GRAVITY ADJUSTMENT IS NORMALLY USED TO ESTABLISH PROPER SETTING FOR TYPE OF FUEL BEING USED. IT SHOULD NEVER BE USED IN ATTEMPTING TO CHANGE OR CORRECT ENGINE PERFORMANCE EXCEPT AS AUTHORIZED BY THE ENGINE MANUFACTURER.

(1)Procedure
(a)Rotate screw assembly in center of specific gravity plate to align scribe mark on screw with appropriate setting line on index plate. Use a 5/32 in. (3.4 mm) Allen Wrench. Use following table for fuel type specific gravity settings.
(b)Use table below for fuel type specific gravity settings.

Type of Fuel	Specific Gravity Setting - 60°F (15.6°C)
Jet A, Jet A1, JP-1 and JP-5	0.82
Jet B or JP-4	
Aviation Gasoline Grades 80/87, 100/130 or 115/145	0.70

D. Minimum Idle Speed Adjustment (Ref. Fig. 506)

(1)Turn minimum idle adjustment screw clockwise (CW) to increase speed ; counterclockwise (CCW) to decrease speed. Use 3/16 in. Allen wrench.
NOTE : One full turn of adjustment screw results in 0.7% (70 rpm) change in N2 speed.

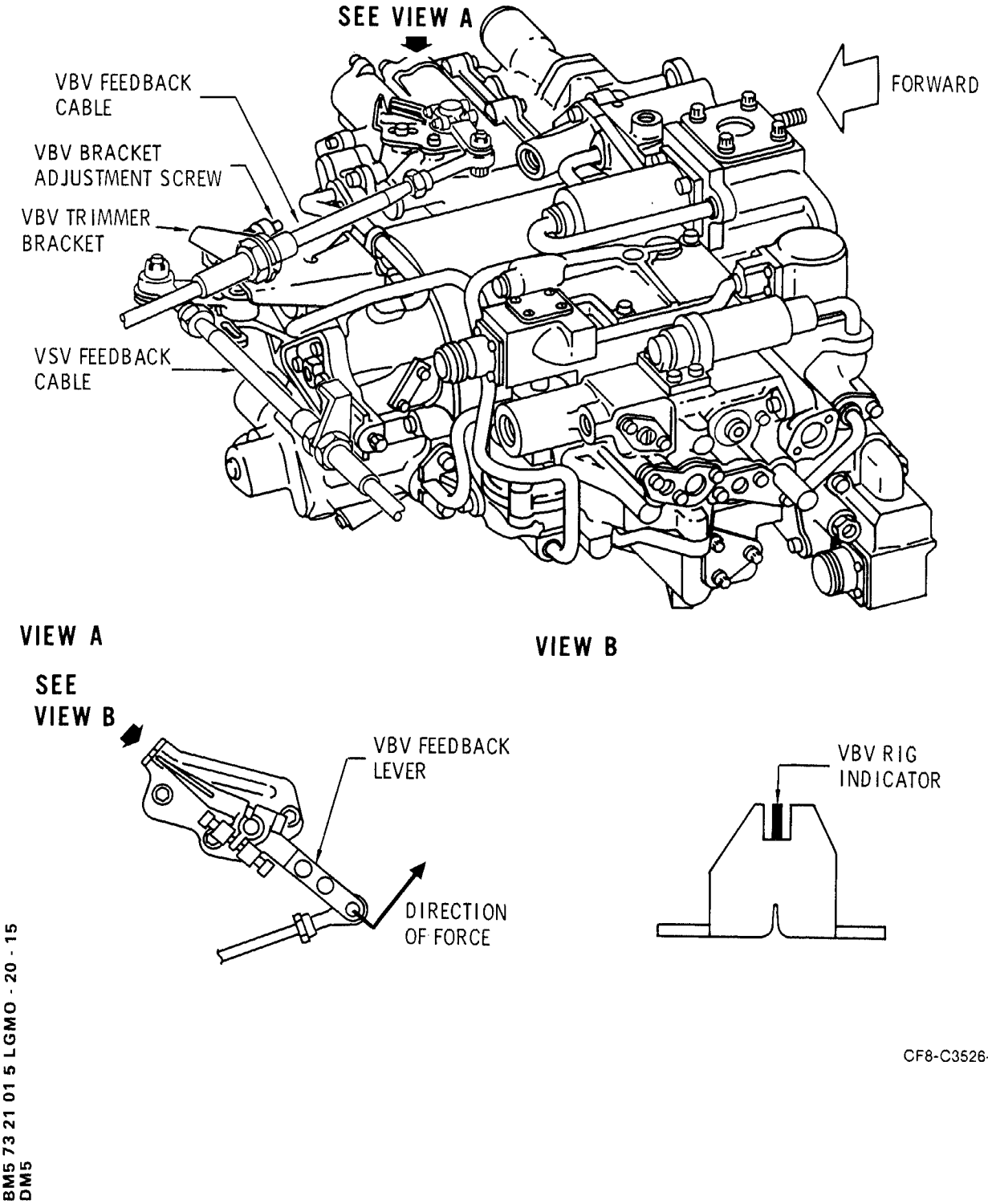
E. Approach Idle Speed Adjustment

WARNING : ENGINE MUST BE SHUT DOWN AND THE FUEL BOOST PUMP DEENERGIZED BEFORE REMOVING APPROACH IDLE ADJUSTMENT ASSEMBLY.

(1)Remove plug covering appproach idle speed adjustment screw (Ref. Fig. 506).
(2)Turn approach idle adjustment screw clockwise (CW) to increase speed and counterclockwise (CCW) to decrease speed. Use a 5/32 in. x 3 in. Allen wrench.
NOTE : One full turn of the adjustment screw results in approximately a 6.8% (680 rpm) change in N2 speed.
(3)Inspect cover plug preformed packing. Replace as required.
(4)Install cover plug. TORQUE to between 10 and 16 lbf.in. (0.11 and 0.12 m.daN).
(5)Check engine parameters (Ref. 72-00-00, P. Block 501).

F. Close-Up

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Close cowl doors (Ref. 71-13-00, P. Block 301). Remove safety clips and tags and close circuit breakers.
(3)Perform idle leak test (Ref. 71-00-00, P. Block 501).



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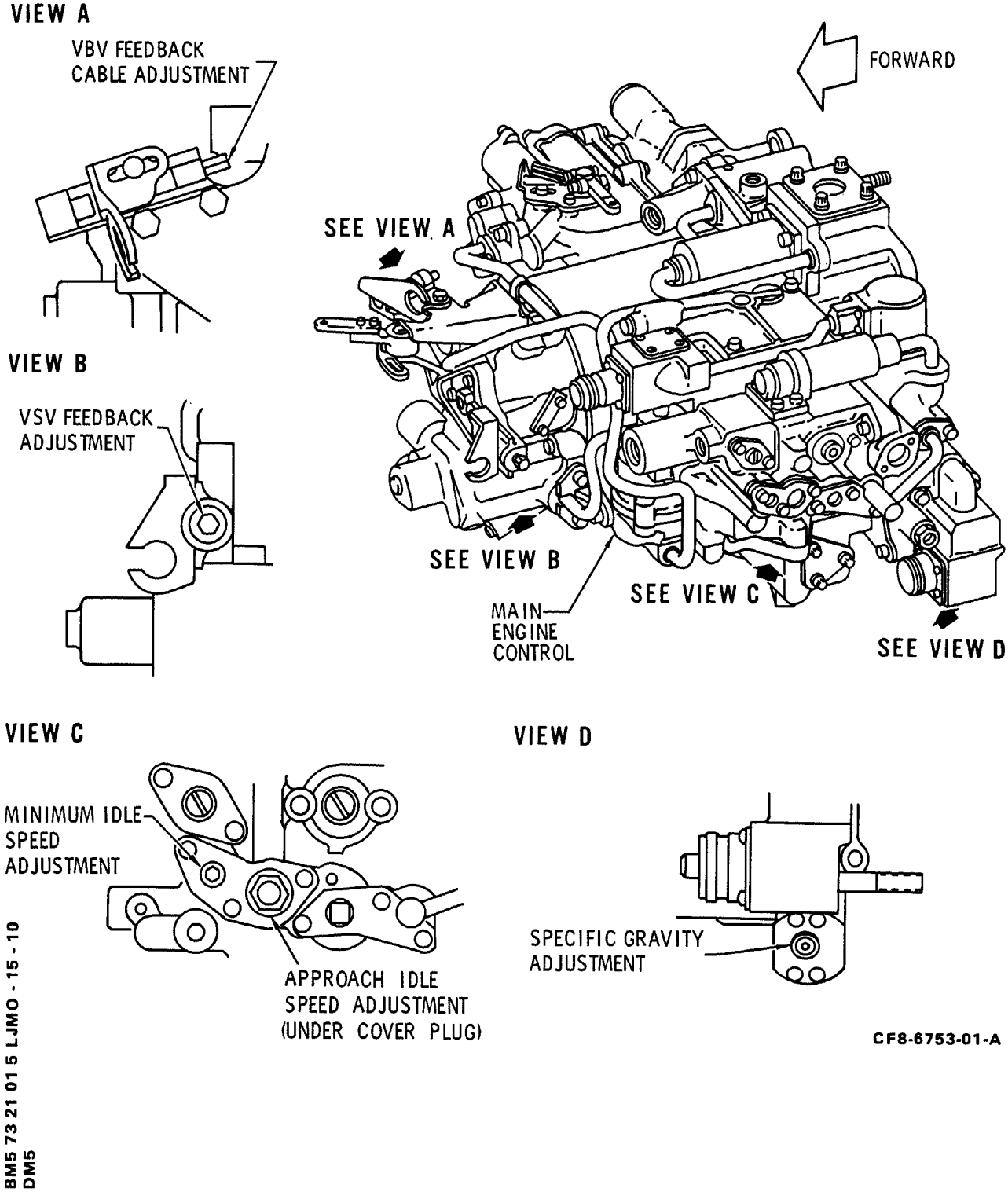
Static Rigging of the VBV Feedback System
Figure 505



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Main Engine Control Adjustments
Figure 506

MAIN ENGINE CONTROL - INSPECTION/CHECK

1. General
Main engine controls (MEC) removed for possible malfunction shall be returned to an authorized shop for test, inspection, and disposition.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breakers Safety Clips
B.	Ohmmeter
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors
- 73-21-01, P. Block 401	Main Engine Control
- 73-21-01, P. Block 801	Main Engine Control

3. Procedure

A. Job Set-Up
(1)Open, safety and tag the appropriate circuits breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Do an idle leak test (Ref. 71-00-00, P. Block 501).

C. Leakage Inspection/Check

INSPECT	MAXIMUM SERVICEABLE LIMITS	REMARKS
PRE GE SB 73-041 * * * (ENGINES WITHOUT LINE REPLACEABLE MEC DRIVE SPLINE ASSEMBLIES)		
(1) Fuel Seal Drain for :		
(a) Leakage	2.0 cc/min. (approximately 40 drops/min.)	Replace MEC (Ref. 73-21-01, P. Block 401)
END PRE GE SB 73-041		
POST GE SB 73-041 * * * (ENGINES WITH LINE REPLACEABLE MEC DRIVE SPLINE ASSEMBLIES)		
(1) Fuel Seal Drain for :		
(a) Leakage	2.0 cc/min. (approximately 40 drops/min.)	Replace MEC Drive Spline Assembly (Ref. 73-21-01, P. Block 801)
END POST GE SB 73-041		
(2) Shutoff Valve for : (a) Leakage	20 cc/min at 0-300 psi (0-2068 Kpa)	Replace MEC (Ref. 73-21-01,

INSPECT	MAXIMUM SERVICEABLE LIMITS	REMARKS
		P. Block 401).

D. After you do the (MEC) leakage inspection/checks, shutdown the engine (Ref. 71-00-00, P. Block 501).

E. Electrical Resistance Inspection/Check
(1)Disconnect electrical connectors.
(2)After inspection attach electrical connectors, handtighten.

INSPECT	MAXIMUM SERVICEABLE LIMITS	REMARKS
(1) Idle Reset Solenoid for :		
(a) Resistance	37-44 ohms (pin-to-pin)	Replace MEC (Ref. 73-21-01, P. Block 401)

F. Close-Up
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Remove safety clips and tags and close circuit breakers. Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

DRIVE SPLINE ASSEMBLY (PART OF THE MAIN ENGINE CONTROL) - APPROVED REPAIRS

1. General

A. This approved repairs is available for engines with line replaceable MEC drive spline assemblies (SB GE 73-041).
The drive spline assembly is a part of the main engine control (MEC).
You must remove the MEC before you can remove the drive spline assembly.

B. This procedure contains a task to remove the assembly and a task to install the assembly.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Depth Micrometer (local Purchase)
B. Material No.C02-008	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant
- 71-13-00, P. Block 301	Cowl Doors
- 73-21-01, P. Block 401	Main Engine Control

3. Replacement of the Drive Spline Assembly

A. Job Set-Up
(1)Open, safety and tag the applicable circuit breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).
(2)Remove the MEC (Ref. 73-21-01, P. Block 401).

B. Removal of the Drive Spline Assembly
(1)Put the MEC on a flat surface with side A down
(Ref. Fig. 801)
(2)Remove the two screws and washers that attach the drive spline assembly to the MEC housing.
CAUTION : MAKE SURE YOU DO NOT PULL THE SHAFT ASSEMBLY OUT OF THE MEC HOUSING. IF THE SHAFT ASSEMBLY IS PULLED OUT, AN INTERNAL SHIM AND SPACER WILL GET INTO THE DRIVE TRAIN AND CAUSE DAMAGE TO THE MEC.
(3)Carefully remove the drive spline assembly from the MEC housing.
NOTE : You will need to keep this assembly to find the thickness of the shim in the installation.
(4)Remove the spacer and the shim.
(a)Keep these parts.
(5)Remove the packing from the MEC housing and discard it.
NOTE : Two packings are installed on the drive spline assembly. One of the packings may remain in the MEC housing.
(6)Remove the packing from the drive spline assembly and discard it.

C. Installation of the Drive Spline Assembly

(1)Do these steps to find the thickness of the shim that is necessary for the installation of the drive spline assembly. (Ref. Fig. 801)

(a)Put the drive spline assembly that you removed on a flat surface with the gear end up.

(b)Put the spacer and the shim on the drive spline assembly.

NOTE : Use the parts that you removed.

(c)Use a depth micrometer to measure from the top of the spacer to the top of the flange on the drive spline assembly.

1 Record this value as dimension D.

(d)Put the spacer and the shim on the drive spline assembly that you will install.

(e)Use a depth micrometer to measure from the top of the spacer to the top of the flange on the drive spline assembly.

(f)Adjust the shim until you have a measured value that is equal to dimension D plus or minus 0.001 in. (0.03 mm).

CAUTION : MAKE SURE YOU DO NOT PULL THE SHAFT ASSEMBLY OUT OF THE MEC HOUSING. IF THE SHAFT ASSEMBLY IS PULLED OUT, AN INTERNAL SHIM AND SPACER WILL GET INTO THE DRIVE TRAIN AND CAUSE DAMAGE TO THE MEC.

(2)Install the spacer in the MEC housing so that it is around the shaft assembly.

(3)Install the two new packings on the drive spline assembly.

(4)Install the shim on the drive spline assembly.

NOTE : Apply a small amount of petrolatum to the shim to help keep it on the drive spline assembly.

(5)Put the drive spline assembly in the MEC housing with the short offset flange at the 6 o'clock position.

NOTE : The short offset flange is the flange that is nearest to the gear shaft. If you look down at the drive spline assembly, you will see that the gear shaft is nearer to one flange.

(6)Install the two washers and screws that attach the drive spline assembly to the MEC housing.

(a)Use a crowfoot wrench to tighten the screws to between 19 and 22 lbf.in. (0.22 and 0.25 m.daN).

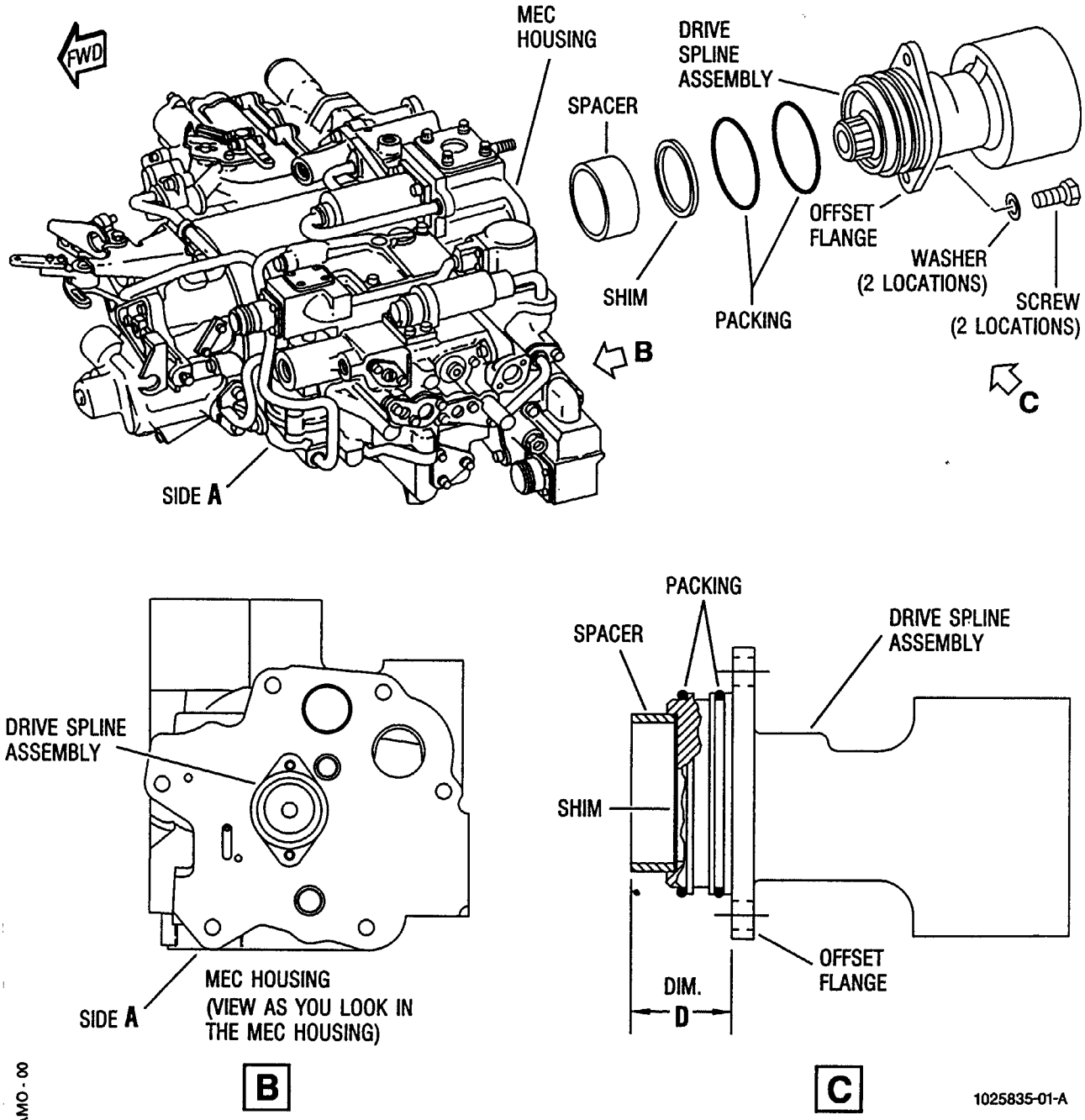
(7)Install the MEC (Ref. 73-21-01, P. Block 401).

(8)Do the test for the MEC that is shown in the "Type of Testing after Engine Component Replacement" (Ref. 71-00-00, P. Block 501).

D. Close-Up

(1)Make certain that the working area is clean and clear of tools and miscellaneous items of equipment.

(2)Remove safety clips and tags and close circuit breakers, thrust reverser, and fan cowl doors (Ref. 71-13-00, P. Block 301).



Drive Spline Assembly
Figure 801

COMPRESSOR INLET TEMPERATURE SENSOR - REMOVAL/INSTALLATION

1. General

This procedure pertains to the removal and installation of the CIT sensor. The sensor is mounted in the fan frame at the 7:30 o'clock position aft looking forward.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Container
C.	Cap and Plugs
D.	Cover
E. Material No.C02-021	Anti-Seize Coumpounds, Lubricants Oils (Ref. 70-00-00)
F.	Corrosion Resistant Steel Lockwire
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl doors

3. Procedure

A. Job Set-Up

(1)Open, safety and tag the appropriate circuit breakers and open the fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401)

(1)Remove safetywire and disconnect the 2 knurled nuts securing the drain cans to the sensor and slide back.

GE SB 72-267 *** (ENGINES WITH CIT DRAIN TUBES)

(1)Remove the drain tubes from the drain cans.

End GE SB 72-267

(2)Disconnect the B-nuts securing the P6 and PB tubes to the sensor.

(3)Remove and discard preformed packings from the drain can knurled nuts.

(4)Remove the four nuts securing sensor to the fan frame.

(5)Pushing back tubes, remove sensor and gasket.

(6)Remove unions from the P6 and PB sensor ports and discard the preformed packings. Retain unions for reuse.

(7)Cover sensor coil and ports with suitable protective covers.

C. Installation (Ref. Fig. 401)

NOTE : Fuel components that have Fluorocarbon (Viton) external seals (SB 73-079) can leak for a short period of time when they are below -29°F (-34°C). If a leak occurs, continue the start to idle.
- If the fuel leakage stops in less than 5 minutes at idle, continue operation of the engine.
- If the fuel leakage continues after 5 minutes at idle, shut down the engine and repair the source of the leakage.

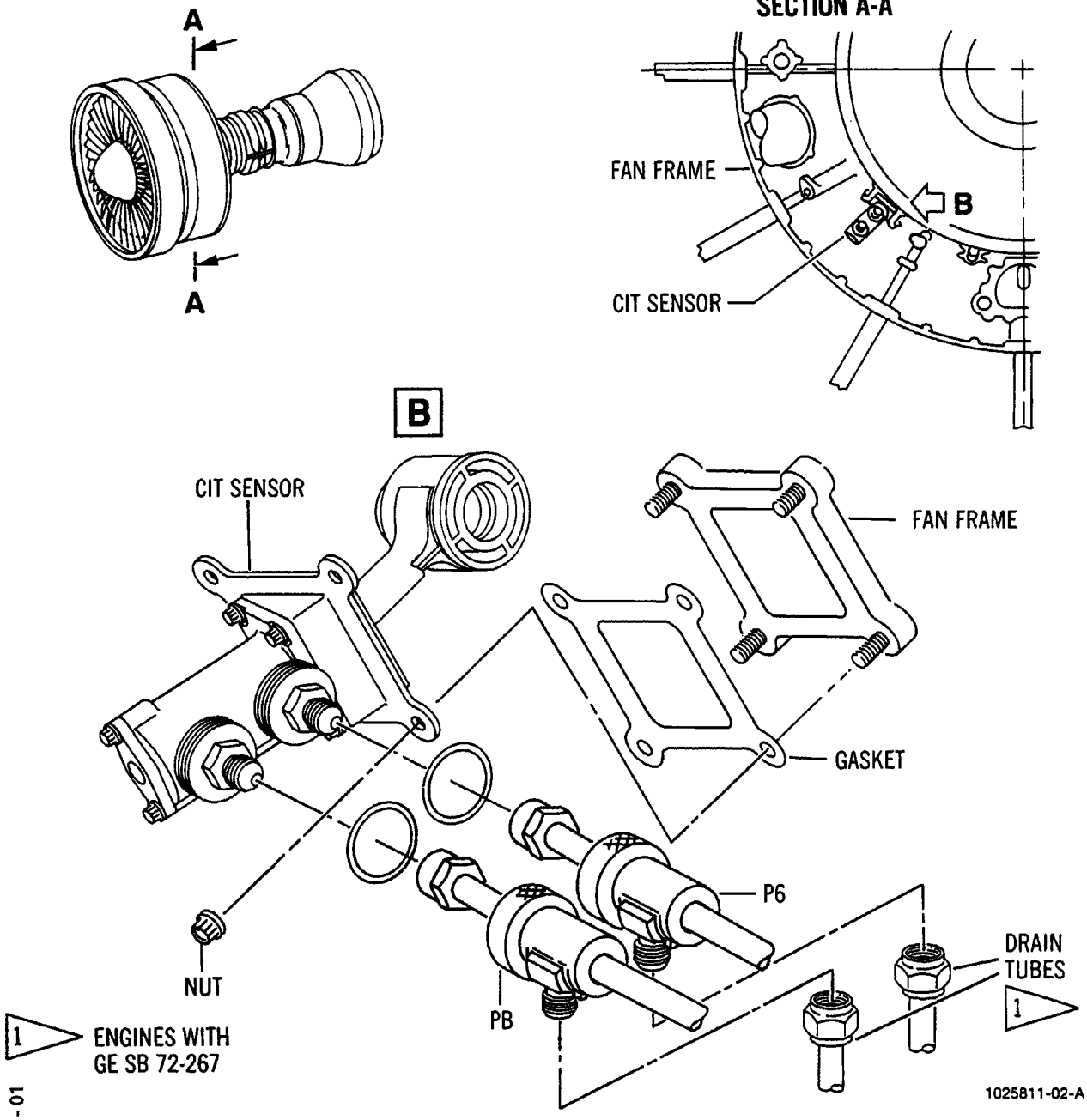
(1)Remove the sensor coil and port protective covers.

(2)Secure gasket and sensor to fan frame with four nuts.TORQUE nuts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
(3)Lightly coat preformed packings with oil (C02-021), and install packings onto unions.
(4)Install unions into sensor P6 and PB ports. TORQUE unions to between 80 and 120 lbf.in. (0.9 and 1.36 m.daN).
(5)Lightly coat preformed packings with oil (C02-021) and install in grooves of drain can knurled nuts.
(6)Connect P6 and PB tubes to the sensor. TORQUE both B-nuts to between 270 and 300 lbf.in. (3.05 and 3.38 m.daN).

(7)Connect drain can knurled nuts to sensor. Tighten hand tight and safetywire.
CAUTION : ON ENGINES WITHOUT DRAIN TUBES (WITHOUT GE SB 72-267), DO NOT INSTALL CAPS ON THE DRAIN CAN FITTINGS, OR FUEL MAY ACCUMULATE IN THE DRAIN CANS.

GE SB 72-267 *** (ENGINES WITH CIT DRAIN TUBES)
(7)Connect the drain tubes to the drain cans. TORQUE to between 135 and 150 lbf.in. (1.52 and 1.69 m.daN).
End GE SB 72-267

D. Close-Up and Test
(1)Make certain that working area is clean and clear of tools and miscelloneous items of equipment
(2)Close fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301). Remove safety clips and tags and close circuit breakers.
(3)Perform test as indicated in "Type of Testing after Engine Component Replacement" (Ref. 71-00-00, P. Block 501).



BM5 73 21 02 4 LAMO - 01

CIT Sensor - Removal/Installation
Figure 401

COMPRESSOR INLET TEMPERATURE SENSOR - INSPECTION/CHECK

1. General

This procedure pertains to the inspection and check of the CIT sensor. Access to the CIT sensor is gained by opening the left fan reverser cowl.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B. Material No.C02-021	Anti-Seize Compounds, Lubricants Oils (Ref. 70-00-00)
Referenced Precedures	
- 71-13-00, P. Block 301	Cowl Doors
- 73-21-02, P. Block 401	Compressor Inlet Temperature Sensor

3. Procedure

A. Job Set-Up

(1)Open, safety and tag the appropriate circuit breakers and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

(2)Remove CIT sensor (Ref. 73-21-02, P. Block 401).

B. Visual Inspection/Check

(1)Inspect the following :

INSPECT/CHECK	MAXIMUMSERVICEABLE LIMITS	REMARKS
(1) All Areas for :		
(a) Leakage	Not serviceable	Replace sensor
(2) Sensing Coil for :		
(a) Nicks and/or dents with 10X glass	None permitted	Replace sensror
(b) Dirt or oil	None permitted	Clean coil

C. Internal Leakage Check.

(1)Disconnect lines from sensor ports as follows :

(a)Disconnect the 2 knurled nuts attaching the drain cans to the sensor and slide back. Discard preformed packings.

(b)Disconnect the B-nuts securing the P6 and PB tubes to the sensor.

WARNING : PROTECT EYES FROM RESIDUAL FUEL WHICH MAY BE BLOWN FROM TUBE.

CAUTION : LUNG PRESSURE IS SUFFICIENT TO MAKE THIS CHECK. THE USE OF HIGH AIR PRESSURE COULD DAMAGE A GOOD SENSOR.

(2)Attach a short piece of plastic tubing to either the P6 or PB port union, and blow into the port using lung pressure only.

(3)Feel for air exiting from the other port. If air can be felt, it

indicates a defective sensor. Replace sensor.

(4 Reconnect lines to sensor as follows :

(a)Lightly coat new preformed packings with engine oil (C02-021) and install into drain cans.

(b)Connect P6 and PB tubes to the sensor ports. TORQUE to between 135 and 150 lbf.in. (1.53 and 1.69 m.daN).

(c)Leak check P6 and PB connections per Removal and Installation.

CAUTION : DRAIN LINE FITTINGS ON THE DRAIN CANS ARE LEFT OPEN. DO NOT CAP DRAIN LINE FITTINGS.

(d)Slide drain cans onto fitting, tighten hand tight and safetywire.

D. Close-Up

(1)Install CIT sensor (Ref. 73-21-02, P. Block 401).

(2)Remove safety clips and tags and close circuit breakers, close fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 401).

N1 SPEED SENSOR (HYDRO-MECH) - REMOVAL/INSTALLATION

1. General

The sensor is mounted to the fan frame at the 4 o'clock position. Access to the sensor is gained by opening the right thrust reverser cowl door.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Access Platform
C.	Container
D.	Caps and Plugs
E.	Cover
F.	Corrosion Resistant Steel Lockwire
G. Material No.C02-021	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)

Referenced Procedures

- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors

3. Procedure

A. Job Set-Up

(1)Open, safety and tag the appropriate circuit breakers and open fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).

(2)Install access platform.

B. Removal (Ref. Fig. 401)

(1)Disconnect overboard drain line from fitting.

NOTE : Some fuel may drain.

(2)Remove safetywire and disconnect knurled nuts from PBR and P8 ports on N1 speed sensor. Slide tube ferrules back to expose fuel tubes. Remove and discard preformed packings from tube ferrules and PBR and P8 fuel tubes.

(3)Disconnect PBR and P8 fuel tubes from sensor.

(4)If you replace the N1 speed sensor, remove PBR and P8 reducer fittings, and the overboard drain fitting. Remove and discard preformed packings.

(5)Remove bolts, washers and nuts securing the sensor to the fan frame adapter.

(6)Remove bolts, washers, and nuts securing the sensor to the bracket and to the fan frame bracket. Remove nut from stud on sensor securing the speed sensor to the snubber bracket.

(a)Keep the bracket for the subsequent installation.

(7)Slide sensor back until spline clears the mounting pad.

(8)Remove sensor and discard preformed packing.

(9)Install protective caps and plugs on the open ports and the engine tubes.

C. Installation (Ref. Fig. 401)

NOTE : Fuel components that have Fluorocarbon (Viton) external seals (SB 73-079) can leak for a short period of time when they are below -29°F (-34°C). If a leak occurs, continue the start to idle.
- If the fuel leakage stops in less than 5 minutes at idle, continue operation of the engine.
- If the fuel leakage continues after 5 minutes at idle, shut down the engine and repair the source of the leakage.

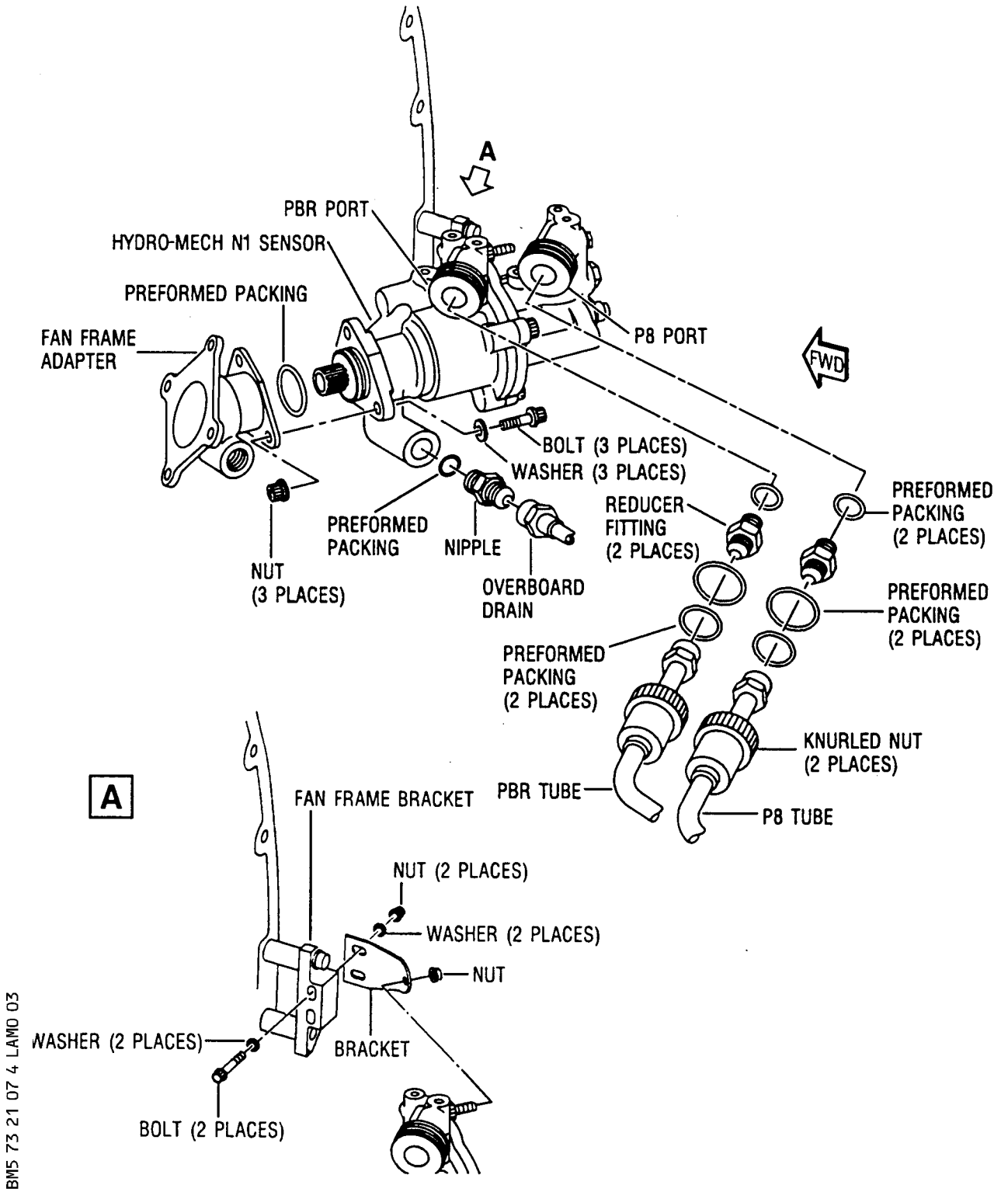
(1) Remove the protective caps and plugs from the open ports and the engines tubes.
(2) Lubricate new preformed packing with Material No.C02-021 and install on sensor.

CAUTION : USE EXTREME CARE DURING INSTALLATION OF N1 SENSOR TO AVOID CONTACT WITH MAGNETIC SEAL IN CONTROL ADAPTER ASSEMBLY. CONTACT COULD CAUSE MISALIGNMENT AND SEPARATION OF SEALING FACES.

(3) Install sensor onto fan frame adapter taking care not to damage spline preformed packing.
(4) Install bolts, washers and nuts. TORQUE nuts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
(5) Attach the bracket to the fan frame bracket and to the sensor with the bolts, washers, and nuts.
  (a) TORQUE the nut that attaches to the stud on the sensor to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
  (b) TORQUE the nuts that attach to the fan frame bracket to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(6) Lubricate new preformed packings with Material No.C02-021 and install onto reducer fittings. Install reducer fittings into P8 and PBR sensor ports and TORQUE to between 135 and 150 lbf.in. (1.52 and 1.69 m.daN).
(7) Lubricate new preformed packing with Material No.C02-021 and install onto nipple of the overboard drain. Install nipple into overboard drain port and TORQUE to between 180 and 200 lbf.in. (2.03 and 2.26 m.daN).
(8) Lubricate new preformed packings with Material No.C02-021 and install on the tube ferrules and PBR and P8 fuel tubes.
(9) Connect fuel tubes (P8, PBR, and overboard drain) to sensor ports. TORQUE tube nuts to between 270 and 300 lbf.in. (3.05 and 3.38 m.daN).
(10) Connect knurled nuts to sensor and hand tighten and wirelock.

D. Close-Up and Test

(1) Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2) Remove access platform.
(3) Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301). Remove safety clips and tags and close circuit breakers.
(4) Perform test as indicated in "Type of testing after engine component replacement "(Ref. 71-00-00, P. Block 501).



N1 Speed Sensor
Figure 401

POWER MANAGEMENT CONTROL - REMOVAL/INSTALLATION

1. General

NOTE : On A/C fitted with NORD MICRO ADC, only PMC post mod. (GE SB 73-015) should be installed. This is due to the potential incompatibility between PMC pre mod (P/N 1339M19P03) mach selection logic.

The following procedure is to be used when removing or installing the power management control (PMC) mounted at the 7 o'clock position on the aft fan stator case. Access to the PMC is gained by opening the left fan cowl.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Corrosion Resistant Steel Lockwire
C.	Torque Wrench 100-150 lbf.in. (1.1 - 1.7 m.daN)
D.	Soft Jawed Pliers
E.	Protective Caps
F. Material No.C02-058	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
Referenced Procedures	
- 71-00-00, P. Block 501	General
- 71-13-00, P. Block 301	Cowl Doors
- 73-23-00, P. Block 501	Power Management Control

3. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
21VU	ENG-TRIM-GND-TEST	8KS	102/H13
22VU	AFS/ENG-TRIM WARN	4KS	207/C21

(2)Open left fan cowl door (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401)

(1)Disconnect cable from engine connector J1.
(2)Disconnect cable from aircraft connector J2.
(3)Remove bolt and nut (2) that attaches grounding wire and PMC to forward mounting flange.
(4)Remove the 4 mounting bolts (1) from PMC and remove PMC. Support the PMC as bolts are removed to prevent it from falling from mounting brackets.
(5)Install protective caps on connectors.

C. Installation (Ref. Fig. 401)

(1)Coat threads and pressure faces of 4 mounting bolts (1) with lubricant

(CO2-058). Position PMC to mounting bracket with the connector end facing down toward the bottom of engine. Attach ground wire to mounting bolt (1) and secure. TORQUE mounting bolts (1) to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).

CAUTION : LOCATING PIN ON THE MOVABLE CONNECTORS MUST BE CORRECTLY POSITIONED WITH RESPECT TO THE MATCHED RECEPTACLE.

(2)Connect J2 aircraft and J1 engine cable to PMC. Hand-tighten connector nuts until fully seated.

NOTE : After connector is seated, tighten connector 1/4 to 1/2 turn with a soft jawed pliers or until slippage occurs.

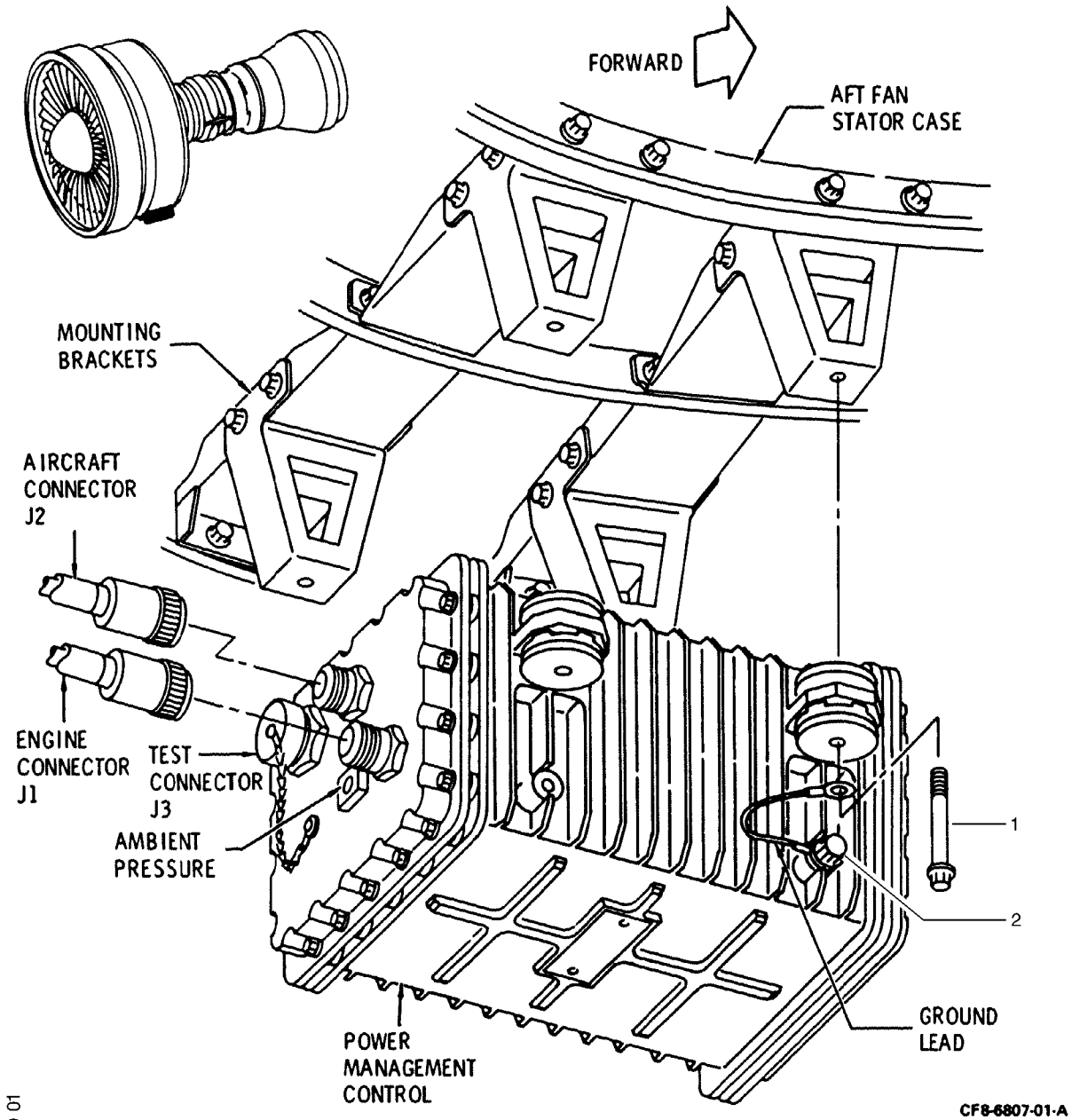
D. Test

(1)Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501).

E. Close-Up

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2)Close left fan cowl doors (Ref. 71-13-00, P. Block 301) and remove safety clips and tags and close circuit breakers 8KS and 4KS.



BM5 73 23 00 4 LAM0 01

Power Management Control - Removal/Installation
Figure 401

1. Operational Test

A. Reason for the Job

The following procedure is designed to check the PMC with the engine off, while applying ground test power to the control. The test may be performed with the TCC and ADCs operational. If the TCC is providing valid TAT data to the PMC under test, the full-throttle fan speed indication check will be near the nominal value. If valid TAT data is not provided by the TCC, the full-throttle fan speed indication check may differ from the value indicated, due to the effect of engine heat or direct sunlight on the fan inlet temperature sensor for the PMC.

B. Equipment and Materials

ITEM	DESIGNATION
Referenced Procedure - 24-41-00, P. Block 301	External Power

C. Procedure

(1)Job set-up

(a)Make certain that the following circuit breakers are closed.

PANEL	SERVICE	IDENT.	LOCATION
133VU	ENG/ENG1/FUEL HP VALVE/WARN	1KC	333/T68
133VU	ENG/ENG2/FUEL HP VALVE/WARN	2KC	335/R73
133VU	ENG/ENG1/FUEL HP VALVE/CTL	3KC	333/T69
133VU	ENG/ENG2/FUEL HP VALVE/CTL	4KC	333/T70
22VU	AFS/ENG/TRIM/WARN	4KS	207/C21
22VU	N1/ENG1	1EJ	207/C15
22VU	N1/ENG2	2EJ	207/C16

(b)Energize the aircraft electrical network (Ref. 24-41-00, P. Block 301).

(c)Make certain that electronics racks ventilation is correct.

(2)Test (Ref. Fig. 502)
(Ref. Fig. 501)

ACTION	RESULT
1. On overhead panel - Check that OFF legend of ENG TRIM pushbutton switch is off	
On center pedestal - Set throttle control lever to IDLE position (0° TLA)	
- Set HP FUEL lever to ON position	- FAULT legend of ENG TRIM push-

ACTION	RESULT
	button switch comes on - N1 actual needle is at zero - N1 actual digital display shows dashes - N1 command needle is at zero.
2. On maintenance panel - Press TRIM TEST pushbutton	- FAULT legend of ENG TRIM push-button will immediately goes off. - N1 actual needle is at zero - N1 digital display will equal N1 command needle value. Both values are obtained (see NOTE 1) within an accuracy of ± 1.5 % N1 - N1 command needle values will be the same on both engines within an accuracy of ± 1.5 % N1.
3. On center pedestal - Set throttle control lever to full forward position (55° TLA). On maintenance panel - Trim test pushbutton still pressed	- FAULT legend of ENG TRIM push-button switch is off. - N1 actual needle is at zero - N1 actual digital display will equal N1 command needle value. Both values are obtained (see NOTE 2) within an accuracy of ± 1.5 % N1. - N1 command needle values will be the same for both engines within an accuracy of ± 1.5 % N1.

NOTE 1 : (Ref. Fig. 502).
NOTE 2 : (Ref. Fig. 501).

ACTION	RESULT
4. Release TRIM TEST pushbutton	- FAULT legend of ENG TRIM pushbutton switch comes on.
5. Close HP fuel lever	- FAULT legend of ENG TRIM pushbutton switch is off.

ACTION	RESULT
6. On center pedestal - Return throttle control lever to IDLE (0° TLA) position	
7. On overhead panel - Remove the guard on ENG TRIM pushbutton switch and press ENG TRIM pushbutton switch.	- OFF legend of ENG TRIM push-button witch comes on.

NOTE : If PMC FAULT light remains on during test, a fault has been detected by the PMC which indicates that a PMC, MEC, associated engine sensor, or aircraft (TLA) failure has occured. Trouble-shooting is then required and can be accomplished with the aid of the information obtained from the PMC ARINC maintenance words.

NOTE : With PMC ground test ON and PMC OFF, if N1 actual digital display remains blank, a non volatile memory failure has been detected. Corresponding PMC has to be changed.

NOTE : The PMC senses its internal temperature and will prevent ground testing when internal temperature exeeds 160°F (71°C).

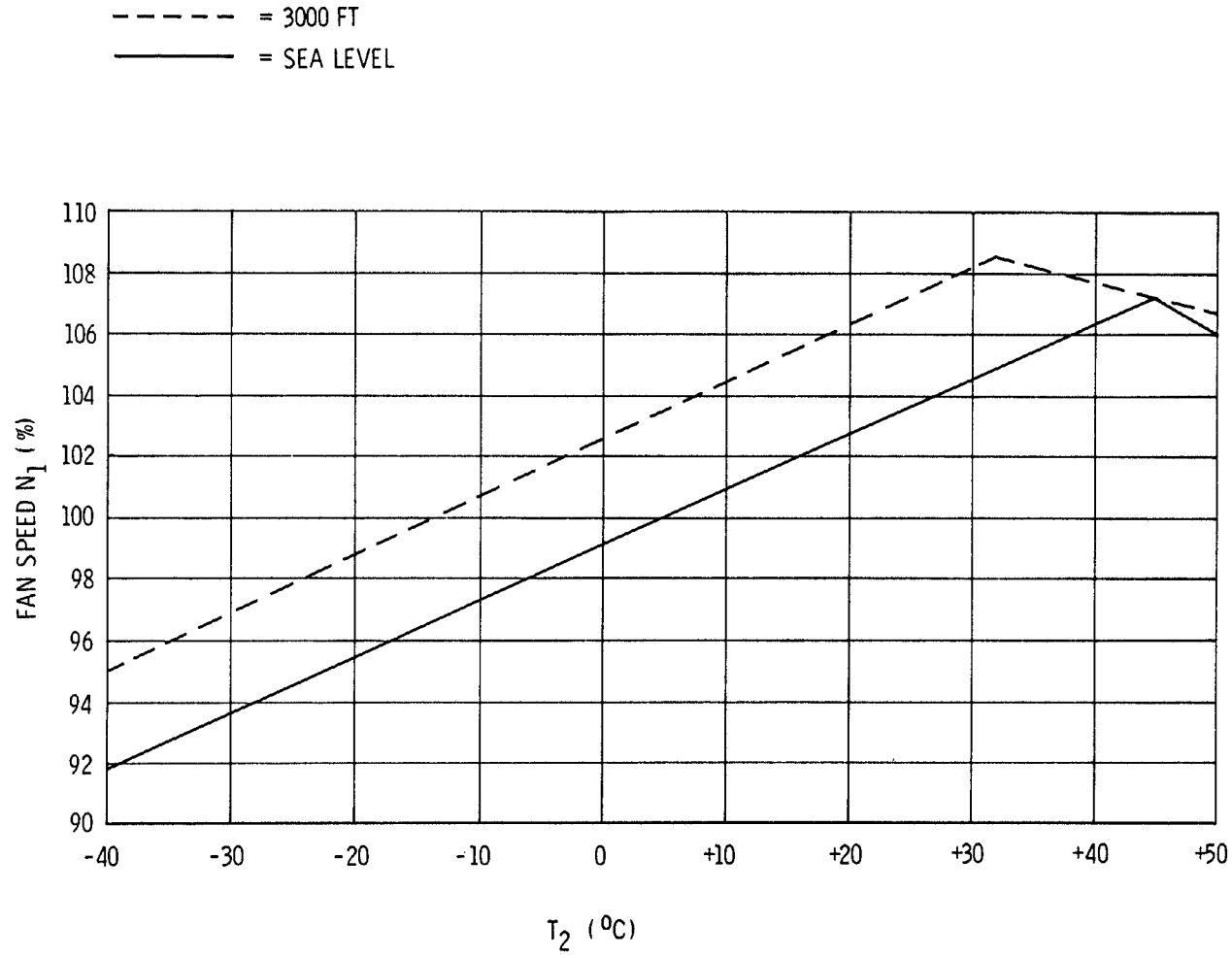
(3)Close-up
(a)De-energize the aircraft electrical network (Ref. 24-41-00, P. Block 301).

2. PMC - Retrieving Non-Volatile Memory

A. Equipment and Materials

ITEM	DESIGNATION
(1)2C14969	PMC Maintenance Reader
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

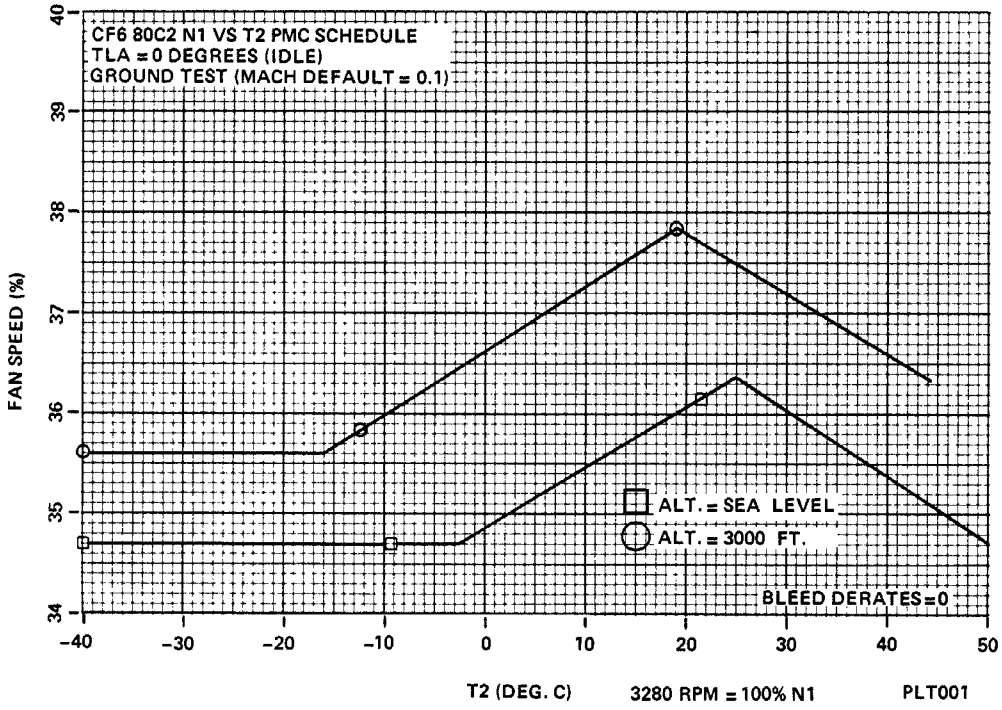
B. Procedure
(1)Job set-up
(a)Open the fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).
(2)Hookup of PMC reader 2C14969 (Ref. Fig. 503)
(a)Disconnect plug D4992P from PMUX if connected.
(b)Connect cable 2C14969P03 to plug disconnected in step 1 and to PMC Maintenance Reader 2C14969 cable.
(3)Fault retrieval
(a)Push and hold "engine trim" button on.



BM5 73 23 00 5 LCMO - 19

CF8-A6056-00-A

Power Management Control - Ground Test (Full Throttle)
Figure 501



BM5 73 23 00 5 LAMO - 15 - 10
DM5

Power Management Control - Ground Test (Idle)
Figure 502

NOTE : For "PMC Fault" assure PMC is off for
"PMC/TCC fault" assure PMC is on.

(b)Setup reader and read faults as follows :

1 Press "ON" button.
2 Press "BIN" button.
3 Set label wheels to "350".
4 Press LED switch on back. Read and record any illuminated data lights (BITS) 17 thru 28 refer to (Ref. Fig. 505) for data recording sheet.
- Repeat for labels 270 and 351 thru 354.
5 Perform required maintenance action per TSM 73-23-00.

(4)Flight counter retrieval

(a)Assure ground test power to PMC is on.

(b)Setup reader and calculate flight number as follows.

1 Press "ON" button.
2 Press "BIN" button.
3 Set label wheels to "251".
4 Read and record any illuminated data lights (BITS) 13 thru 28. Refer to (Ref. Fig. 506, 507) for sample data recording calculation sheet.
5 Calculate flight numbers by adding significant numbers adjacent to illuminated data lights (bits). Example shown in (Ref. Fig. 507).
6 Turn reader off by pressing "ON" button.

(5)Disconnect reader

(a)Disconnect reader cable 2C14969P03 from PMUX cable.

(b)Reconnect PMUX cable to PMUX (if required).

(6)Close-up

(a)Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

3. PMC-Retrieving Non-Volatile Memory (Alternate Procedure with PMC Maintenance Reader)

A. Equipment and Materials

ITEM	DESIGNATION
(1)	PMC Maintenance Reader

B. Procedure

(1)Hookup of PMC reader on panel 90VU (Ref. Fig. 504)

(a)Remove cap from plug 62FL1 (62FL2).

(b)Insert pins into contacts (M), (N) and (Z) of plug 62FL1 (62FL2).

(2)Fault retrieval

(a)Push and hold "engine trim" button on.

NOTE : For "PMC Fault" assure PMC is off for
"PMC/TCC fault" assure PMC is on.

(b)Setup reader and read faults as follows :

1 Press "ON" button.
2 Press "BIN" button.
3 Set label wheels to "350".
4 Press LED switch on back. Read and record any illuminated data lights (BITS) 17 thru 28 refer to (Ref. Fig. 505) for data recording sheet.

- Repeat for labels 270 and 351 thru 354.

5 Perform required maintenance action per TSM 73-23-00.

(3)Flight counter retrieval

(a)Assure ground test power to PMC is on.

(b)Setup reader and calculate flight number as follows.

1 Press "ON" button.

2 Press "BIN" button.

3 Set label wheels to "251".

4 Read and record any illuminated data lights (BITS) 14 thru 28. Refer to (Ref. Fig. 506, 507) for sample data recording calculation sheet.

5 Calculate flight numbers by adding significant numbers adjacent to illuminated data lights (bits). Example shown in (Ref. Fig. 507).

6 Turn reader off by pressing "ON" button.

(4)Disconnect reader

(a)Remove pins from contacts (M), (N) and (Z) of plug 62FL1 (62FL2).

(b)Install cap to plug 62FL1 (62FL2).

4. PMC-Retrieving Non-Volatile Memory (Alternate Procedure with AIDS)

A. Procedure

R NOTE : The following procedure is only applicable to Hamilton CDU.

(1)Fault retrieval AIDS

(a)Turn ground test power on to PMC and AIDS.

R Push and hold "engine trim test" button on.

(b)Access data (Ref. Fig. 508).

1 Press "CLR" (clear) button.

2 Press "2" - "IN" buttons.
EQID LABEL is displayed.

3 Press "3" - "4" (PMUX) buttons.

4 Call label number (350 thru 354) pressing "3" - "5" - "0" buttons.

5 Press "0" - "1" buttons for engine 1,
or "1" - "0" buttons for engine 2.

6 Press "IN" button.

(c)Read and record octal (or hexadecimal) number.

(d)Repeat steps (a) thru (c) for labels 270 and 351 thru 354.

(e)Convert octal (or hexadecimal) number to binary (Ref. Fig. 509, 510).

1 Convert octal display to binary using chart (Ref. Fig. 509) (1's are significant) or convert hexadecimal display to binary using chart (Ref. Fig. 510) (1's are significant).

2 Assign ARINC 429 digital bus bit numbers to the binary number.
NOTE : Disregard all bits except 17 thru 28.

3 Identify the meaning of all bits which where reset to "1" per TSM 73-23-00,

4 Label 270 is status.

(2)Flight counter retrieval AIDS

(a)Assure ground test power to PMC and AIDS is on.

(b)Access data (Ref. Fig. 508).

1 Press "CLR" (clear) button.

2 Press "2" - "IN" buttons.
EQID LABEL is displayed.
3 Press "3" - "4" (PMUX) buttons.
4 Call label number 251 pressing "2" - "5" - "1" buttons.
5 Press "0" - "1" buttons for engine 1,
or "1" - "0" buttons for engine 2.
6 Press "IN" button.
(c)Read and record octal (or hexadecimal) number.
(d)Convert octal (or hexadecimal) number to binary
(Ref. Fig. 509, 510).
1 Convert octal display to binary using chart (Ref. Fig. 509)
(1's are significant) or convert hexadecimal display to binary
using chart (Ref. Fig. 510) (1's are significant).
2 Assign ARINC 429 digital bus bit numbers to the binary number.
NOTE : Disregard all bits except 13 thru 28.
3 Calculate flight number by adding significant numbers
adjacent to bit number (Ref. Fig. 506, 507).

5. Engine Rating Code in Correspondance with the Engine Model

A. Equipment and Material

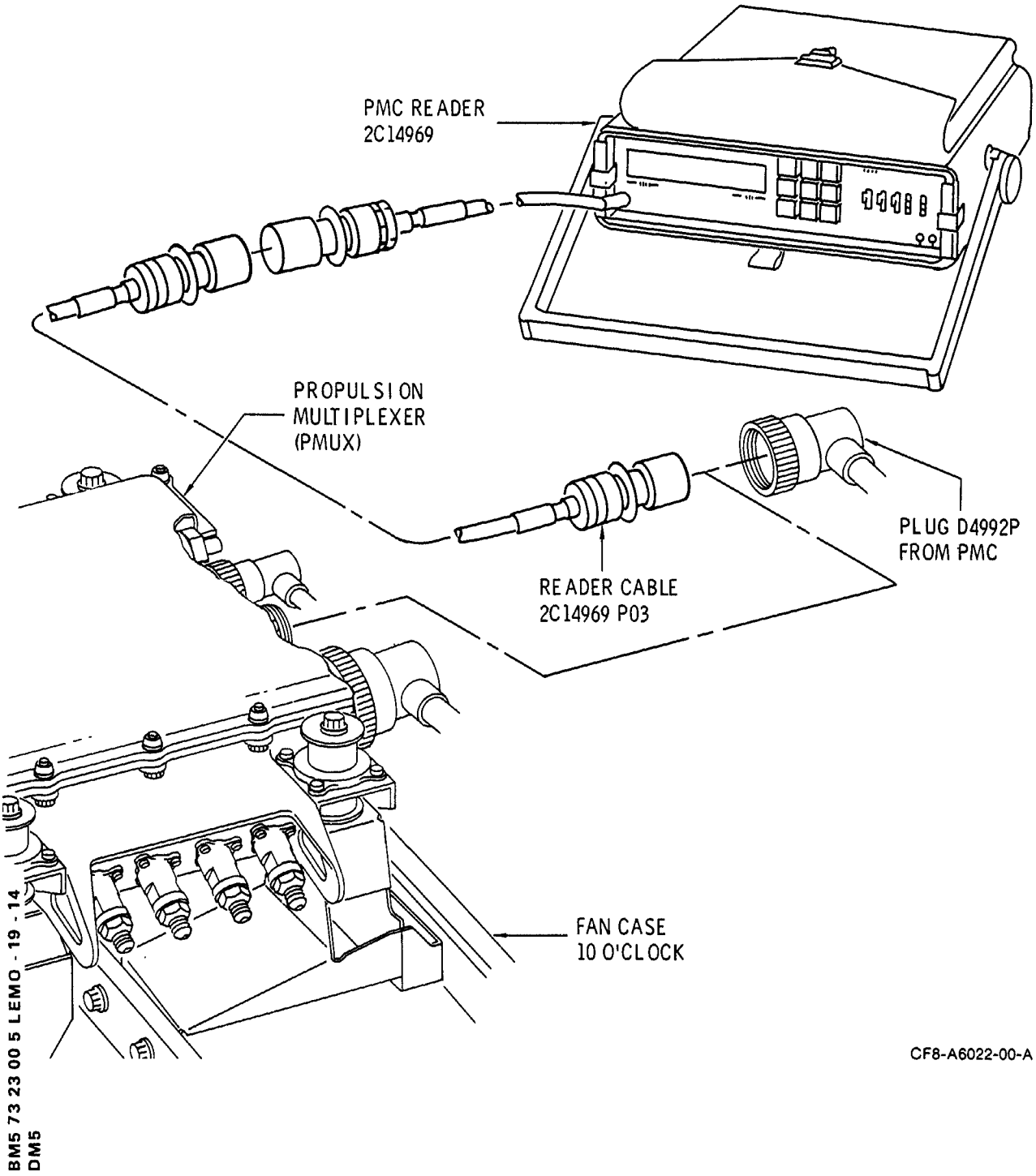
ITEM	DESIGNATION
(1)2C14969	PMC Maintenance Reader

B. Procedure with PMC Maintenance Reader
(1)Hookup of PMC reader on panel 90VU.
(a)Remove cap from plug 62FL1 (62FL2).
(b)Insert pins into contact (M), (N) and (Z) of plug 62FL1 (62FL2).
(c)Push and hold "engine trim test" button on.
(d)Set up reader
1 Press "ON" button
2 Press "BIN" button
3 Set label wheels to "271"
4 Press LED switch on back of PMC reader. Read and record any
illuminated data light for Bit 17 to 19
5 Check that the reading of label "271" is in accordance with Table 1.

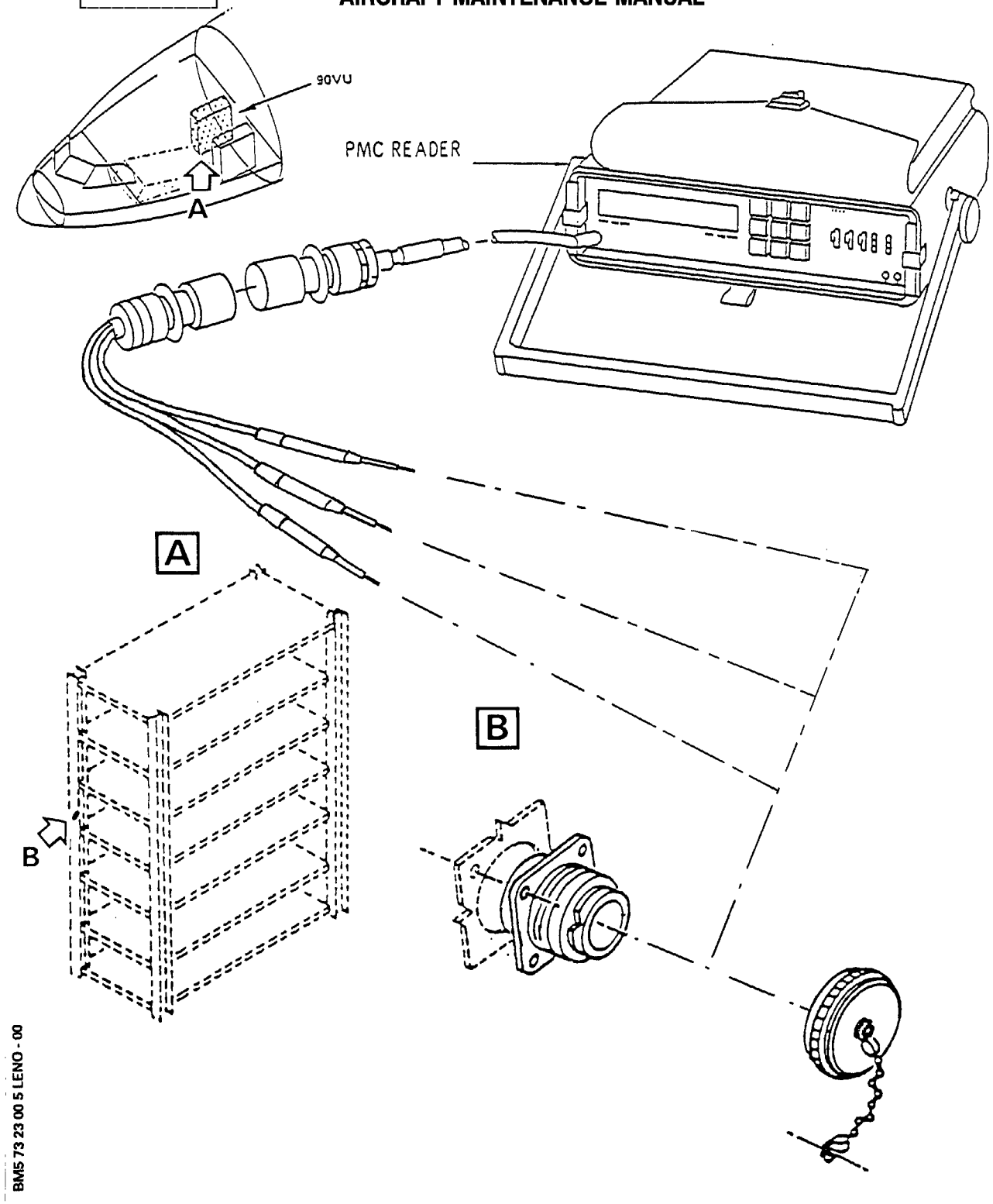
LABEL 271	bit 17	bit 18	bit 19	Engine model
CF6-80C2	0	0	1	CF6-80C2 A1
	1	0	1	CF6-80C2 A2
	0	1	1	CF6-80C2 A3
	1	1	1	CF6-80C2 A5
	1	0	0	CF6-80C2 A8

Table 1

C. Procedure with AIDS (Hamilton CDU)



PMC Retrieving Non-Volatile Memory Hookup
Figure 503



PMC Retrieving Non-Volatile Memory Hookup
Figure 504

LABELS

BIT	270	350	351	352	353	354
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						

NOTES:

1. IF BIT LIGHT IS ILLUMINATED PLACE "L" UNDER APPROPRIATE LABEL AND ADJACENT TO APPROPRIATE BIT.

2. REFER TO TROUBLESHOOTING MANUAL.

BM5 73 23 00 5 LGMO - 01/30 - 01/24
DM5

PMC Fault Recording Sheet
Figure 505

PMC FLIGHT COUNTER

RECORDING/CALCULATION SHEET
(LABEL 251)

BIT	SIGNIFICANCE OF BIT BEING ILLUMINATED	CALCULATION
17	1	_____
18	2	_____
19	4	_____
20	8	_____
21	16	_____
22	32	_____
23	64	_____
24	128	_____
25	256	_____
26	512	_____
27	1024	_____
28	2048	_____
13	4096	_____
14	8192	_____
15	16384	_____
16	32768	ADD (+) _____
		EQUAL (+) _____ FLIGHT NUMBER

CIRCLE BITS ILLUMINATED

BM5 73 23 00 5 LJMO - 19 - 14
DM5

PMC Flight Counter Recording/Calculation Sheet
(Label 251)
Figure 506

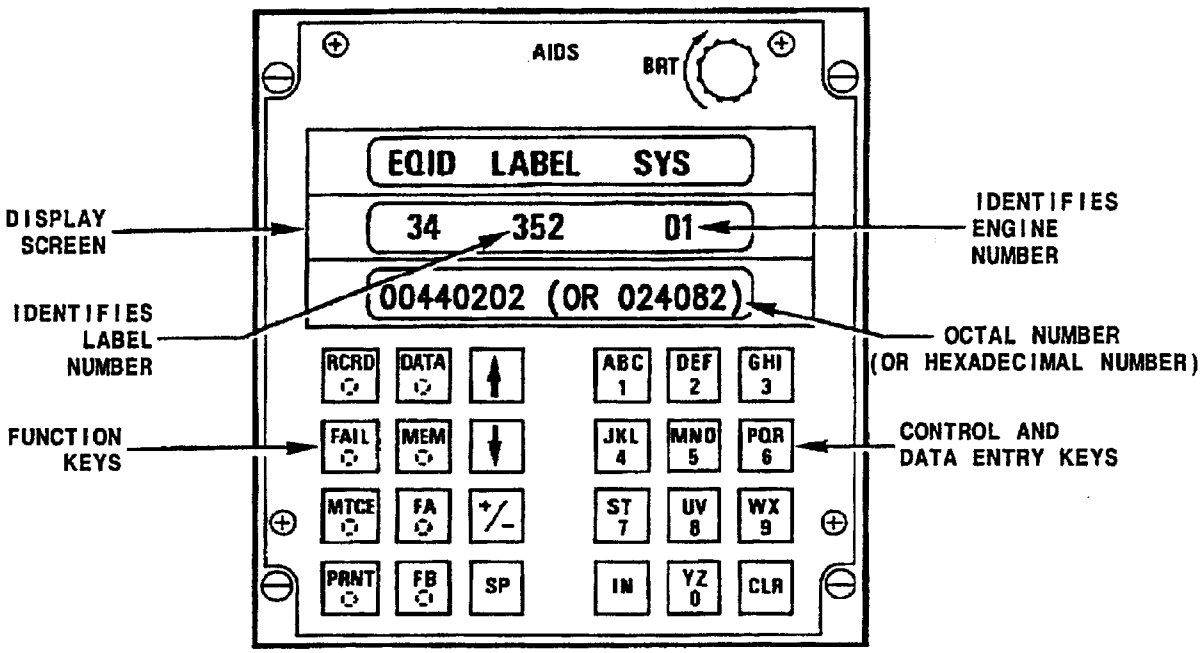
BIT	SIGNIFICANCE OF BIT BEING ILLUMINATED	CALCULATION
17	1	
18	2	
19	4	4
20	8	
21	16	
22	32	
23	64	
24	128	128
25	256	
26	512	
27	1024	1024
28	2048	
13	4096	
14	8192	
15	16384	
16	32768	
	ADD (+)	
	EQUAL (+)	FLIGHT NUMBER
		1156

CIRCLE BITS ILLUMINATED

BM5 73 23 00 5 LLMO - 19 - 14
DM5

PMC Flight Counter Recording/Calculation Sheet
(Label 251)
Figure 507

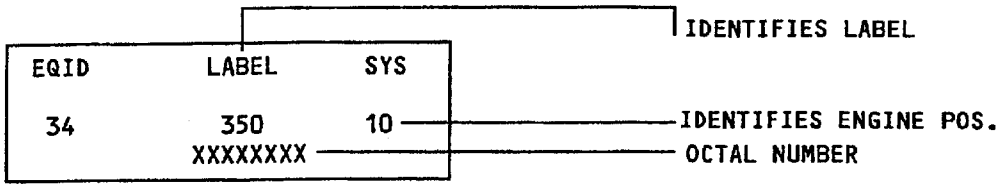
CDU PANEL



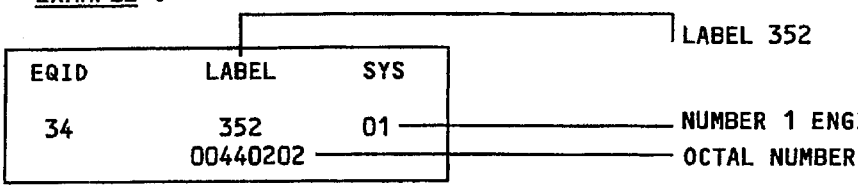
BM5 73 23 00 5 LPM0 00

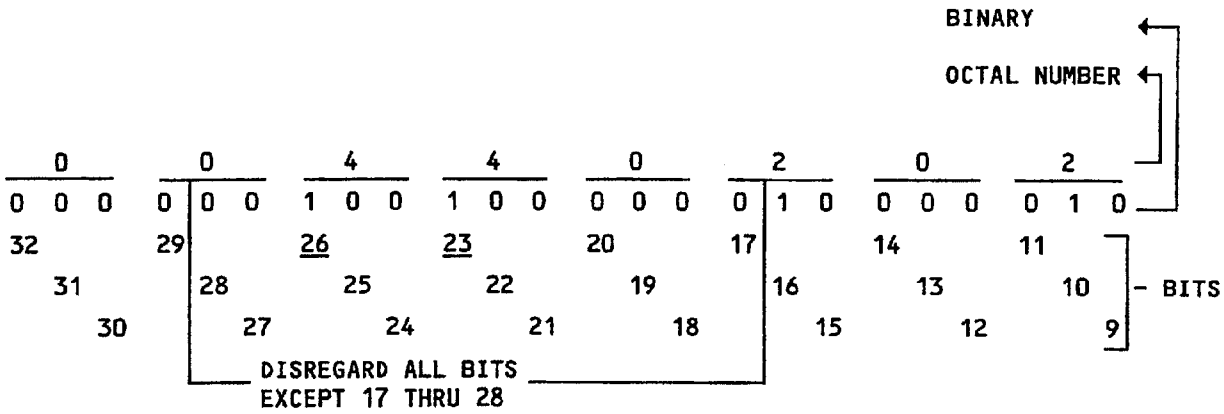
Access Data AIDS (Hamilton CDU)
Figure 508

R



EXAMPLE :





IN THE ABOVE EXAMPLE BITS 23 AND 26 ARE SET TO 1 AND THEREFORE ARE SIGNIFICANT AND IDENTIFY A FAULT. ALL OTHER REMAIN AT 0 AND ARE NOT SIGNIFICANT.

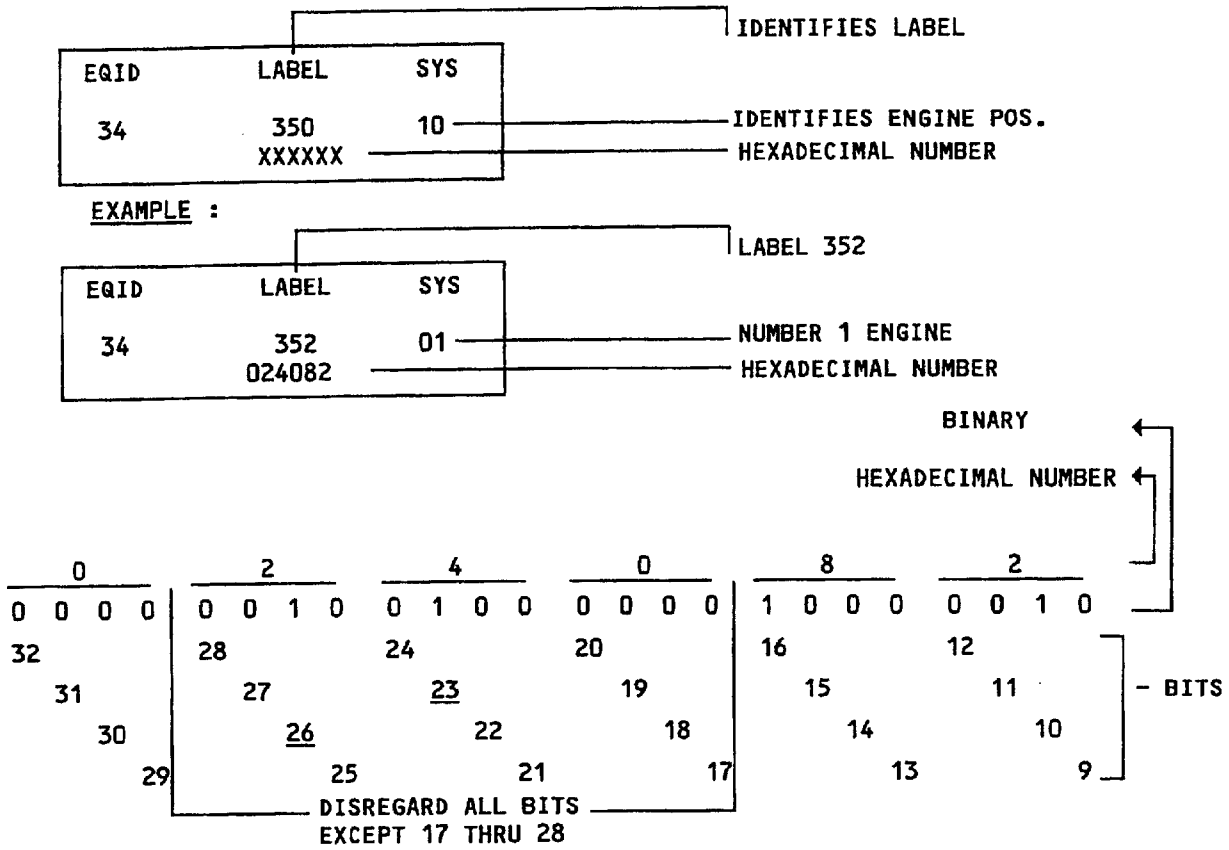
THEREFORE IN THIS EXAMPLE :
352-23 DIGITAL N1 INPUT OUT OF RANGE
352-26 N1 ACTUAL RATE FAULT COUNTER REACHED LIMIT.

CHART

OCT	BINARY
0	000
1	001
2	010
3	011
4	100
5	101
6	110
7	111

BM5 73 23 00 5 LRM0 00

Convert Octal to Binary Number
Figure 509



IN THE ABOVE EXAMPLE BITS 23 AND 26 ARE SET TO 1 AND THEREFORE ARE SIGNIFICANT AND IDENTIFY A FAULT. ALL OTHER REMAIN AT 0 AND ARE NOT SIGNIFICANT.

THEREFORE IN THIS EXAMPLE :
352-23 DIGITAL N1 INPUT OUT OF RANGE
352-26 N1 ACTUAL RATE FAULT COUNTER REACHED LIMIT.

CHART

HEXADECIMAL	BINARY	HEXADECIMAL	BINARY
0	0000	8	1000
1	0001	9	1001
2	0010	A	1010
3	0011	B	1011
4	0100	C	1100
5	0101	D	1101
6	0110	E	1110
7	0111	F	1111

BM5 73 23 00 5 LSM0 00

Convert Hexadecimal to Binary Number
Figure 510

(1)Assure ground test power to PMC and AIDS is on.
R Push and hold "engine trim test" button on.
(2)Access data (Ref. Fig. 508).
(a)Press "CLR" (clear) button.
(b)Press "2" - "IN" buttons.
EQID LABEL is displayed
(c)Press "3" - "4" (PMUX) buttons.
(d)Call label number 271 pressing "2" - "7" - "1" buttons.
(e)Press "0" - "1" buttons for engine 1,
or "1" - "0" buttons for engine 2.
(f)Press "IN" button.
(3)Read and record octal (or hexadecimal) number.
(4)Convert octal (or hexadecimal) number to binary
(Ref. Fig. 509, 510).
(a)Convert octal display to binary using chart (Ref. Fig. 509)
(1's are significant) or convert hexadecimal display to binary
using chart (Ref. Fig. 510) (1's are significant).
(b)Assign ARINC 429 digital bus bit numbers to the binary number.
NOTE : Disregard all bits except 17 thru 19.
(5)Check that the reading of label "271" is in accordance with Table 1.

LABEL 271	bit 17	bit 18	bit 19	Engine model
CF6-80C2	0	0	1	CF6-80C2 A1
	1	0	1	CF6-80C2 A2
	0	1	1	CF6-80C2 A3
	1	1	1	CF6-80C2 A5
	1	0	0	CF6-80C2 A8

Table 1

D. Procedure with AIDS (Sagem CDU)
(1)Assure ground test power to PMC and AIDS is on.
R Push and hold "engine trim test" button on.
(2)Access data (Ref. Fig. 511).
(a)Press the MEN key. The list of the menus available appears on
the screen.
(b)Select the DITS IN menu by mean of the UP and DOWN keys (W and X)
and then press the INS key to enter in the menu.
(c)Enter the label 273 by pressing "2" - "7" - "3" keys. Then press
the INS key.
(d)Enter the SDI "0".
Then press the INS key.
(e)Enter the bus number 18 by pressing "1" - "8" keys for the engine 1,
or 19 by pressing "1"-"9" keys for the engine 2. Then press the
INS key.
(f)The parameter is displayed on the screen.
(3)Read and record octal number.
(4)Convert octal number to binary
(Ref. Fig. 509).

(a)Convert octal display to binary using chart (Ref. Fig. 509) (1's are significant).

(b)Assign ARINC 429 digital bus bit numbers to the binary number.

NOTE : Disregard all bits except 26 thru 29.

(5)Check that the reading of label "273" is in accordance with Table 1.

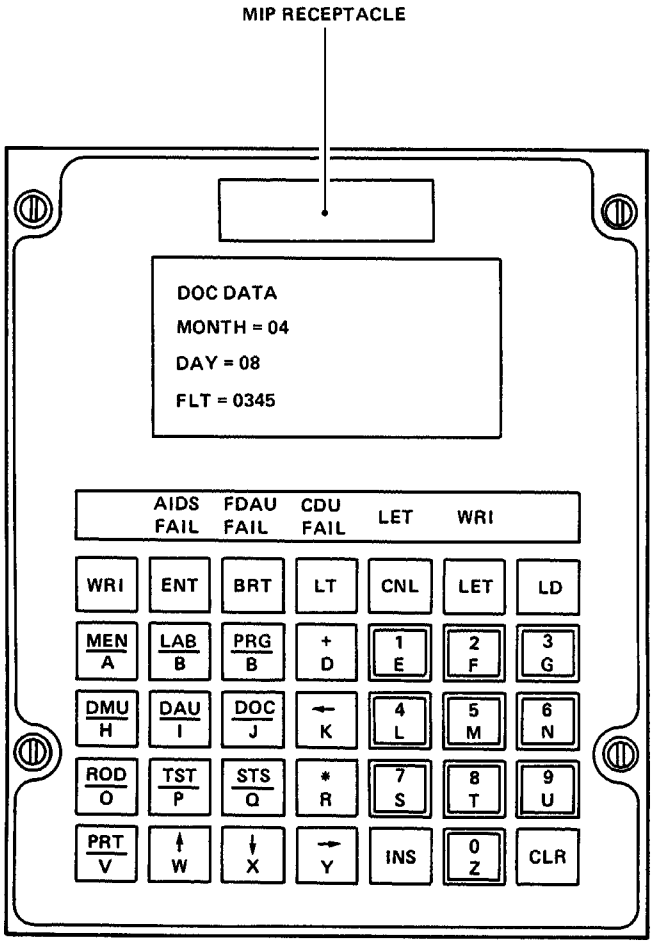
LABEL 273	Bit 26	Bit 27	Bit 28	Bit 29	Engine model (1st 3 digits of Serial Number
	1	1	0	0	CF6-80C2 (690)

Table 1

(6)Read the engine serial number which is coded on the label 273 bit 25 thru 14 (see Table 2).

Plug Serial Number	Engine Serial Number	Bit 25	Bit 24	Bit 23	Bit 22	Bit 21	Bit 20	Bit 19	Bit 18	Bit 17	Bit 16	Bit 15	Bit 14
0001	690-001	0	0	0	0	0	0	0	0	0	0	0	1
0002	690-102	0	0	0	1	0	0	0	0	0	0	1	0
0003	690-103	0	0	0	1	0	0	0	0	0	0	1	1
0004	690-104	0	0	0	1	0	0	0	0	0	1	0	0
0005	690-105	0	0	0	1	0	0	0	0	0	1	0	1
0006	690-106	0	0	0	1	0	0	0	0	0	1	1	0

Table 2



BM5 73 23 00 5 LTM0 00

R

Access Data AIDS (Sagem CDU)
Figure 511

1. Equipment and Materials

ITEM	DESIGNATION
A.	Soft Jawed Pliers
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 73-23-00, P. Block 501	Power Management Control

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
21VU	ENG-TRIM-GND-TEST	8KS	102/H13
22VU	AFS/ENG-TRIM WARN	4KS	207/C21

(2)Open, safety and tag the appropriate circuits breakers and open right fan cowl door (Ref. 71-13-00, P. Block 301).

B. Visual Inspection/Check

Inspect/Check	Maximum Serviceable Limits	Remarks
(1)Mounting Flange for :		
(a)Cracks	None allowed	Replace PMC
(b)Deformation	Any amount, provided still attached securely to mounting bracket	Replace PMC
(2)Casing for :		
(a)Cracks	None allowed	Replace PMC
(b)Dents	Any amount, provided unit is still sealed to moisture	Replace PMC
(c)Nicks and scratches	Any amount not through metal thickness	Replace PMC
(d)Deformation (ballooning)	None allowed	Replace PMC
(3)Connectors for :		

Inspect/Check	Maximum Serviceable Limits	Remarks
(a)Cracks	None allowed	Replace PMC
(b)Crossed threads	None allowed	Replace PMC
(c)Nicked threads	Any amount not beyond complete depth of thread	Chase threads or replace PMC
(d)Bent pins	None allowed	Replace PMC
(e)Pins arcing	None allowed	Replace PMC
(f)Dirt in connector	None allowed	Clean with soft bristle brush or replace PMC
(4)Shock Mounts for :		
(a)Cracks	None allowed	Replace shock mount
(b)Compressibility	Equal compression on all 4 shock mounts	Realign PMC mounting on shock mounts

C. Close-Up
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Close right fan cowl doors. Remove safety clips and tags and close related circuit breakers (Ref. 71-13-00, P. Block 301) together with circuit breakers 8KS and 4KS.

D. Test
(1)Carry out power management control test (Ref. 73-23-00, P. Block 501).

POWER MANAGEMENT CONTROL (PMC) CABLES - REMOVAL/INSTALLATION

1. General

The PMC is located on the fan case at the 7 o'clock position.
Two cables disconnect from the PMC. One is the engine interface cable, and the other is the aircraft interface cable. This procedure is for the removal and installation of the engine interface cables. Access to the PMC and cables is gained by opening the fan and core cowl (Ref. 71-13-00, P. Block 301).

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Protective Caps
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

3. Procedure

A. Job Set-Up

R (1)Open, safety and tag the following circuit breaker :

PANEL	SERVICE	IDENT.	LOCATION
R R 22VU	AFS/ENG-TRIM WARN	4KS	207/C21

(2)Open, safety and tag the appropriate circuit breakers and open cowl doors (Ref. 71-13-00, P. Block 301).

Pre SB GE 72-405

B. Removal of the PMC Cables

(1)Removal of the W-1 cable (Ref. Fig. 401) (Sheet 1/3).
(a)Disconnect plug P8 on the pylon barrier assembly located at the 6 o'clock position on the aft fan case.
(b)Disconnect plug P10 on the main engine control (MEC) located on the accessory module.
(c)Disconnect plug P11 from the N1, sensor located on the fan frame at the 2 o'clock position.
(d)Remove all loop clamps and remove cable W-1.
(e)Place protective caps on all receptacles.

(2)Removal of the W-2 cable (Ref. Fig. 401) (Sheet 2/3).
(a)Disconnect plug P12 on the control alternator located on the accessory module.
(b)Disconnect plug P9 from the pylon barrier assembly located at the 6 o'clock position on the aft fan case.
(c)Remove all loop clamps and remove cable W-2.
(d)Place protective caps on all receptacles.

(3)Removal of the W-3 cable (Ref. Fig. 401) (sheet 3/3).
(a)Disconnect plug P1 from the PMC located on the aft fan case at the

7 o'clock position.
(b)Disconnect plugs P4 and P5 from the aircraft interface located at the 7:30 o'clock position on the forward fan case.
(c)Disconnect plugs P6 and P7 from the pylon barrier assembly located at the 6 o'clock position on the aft fan case.
(d)Disconnect plug P3 from the T-12 sensor located at the 11 o'clock position on the forward fan case.
(e)Remove all loop clamps and remove cable W-3.
(f)Place protective caps on receptacles.

End Pre SB GE 72-405
Post SB GE 72-405
NOTE : SB GE 72-405 replaced the W1, W2 and W3 electrical cables with a single W1 cable.

B. Removal of the W1 Cable
(1)Removal of the W1 cable (Ref. Fig. 402, 403)
(a)Disconnect connector P10 from the N1 DMD connection on the main engine control (MEC), located on the accessory module (Ref. Fig. 403) (Sheet 1/3).
(b)Disconnect connectors P92 and P102 from the N1 fan speed sensor, located on the fan frame at the 2 o'clock position (Ref. Fig. 403) (Sheet 1/3).
(c)Disconnect connector P12 from the control alternator, located on the accessory module (Ref. Fig. 403) (Sheet 2/3).
(d)Disconnect connector P1 from the PMC, located on the aft fan case at the 7 o'clock position (Ref. Fig. 403) (Sheet 3/3).
(e)Disconnect connectors P4 and P5 from the aircraft interface, located on the forward fan case at the 7:30 o'clock position (Ref. Fig. 403) (Sheet 3/3).
(f)Disconnect connector P3 from the T12 sensor, located on the forward fan case at the 11 o'clock position (Ref. Fig. 403) (Sheet 3/3).
(g)Remove all necessary loop clamps and remove W1 cable.
(h)Put protective caps on all connector receptacles.

End Post SB GE 72-405
Pre SB GE 72-405

C. Installation of the PMC Cables
(1)Installation of the W-1 cable (Ref. Fig. 401) (sheet 1/3).
(a)Remove all protective caps from the receptacles.
(b)Connect plug P11 to the N1, sensor located at the 2 o'clock position on the fan frame.
(c)Connect plug P10 to the N1 of the main engine control (MEC) located on the accessory module.
(d)Connect plug P-8 to the receptacle on the pylon barrier assembly located at the 6 o'clock position on the aft fan case.
(e)Install all loop clamps to support cable W-1.
(2)Installation of the W-2 cable (Ref. Fig. 401) (sheet 2/3).
(a)Remove all protective caps from the receptacles.
(b)Connect plug P9 to the receptacle on the pylon barrier assembly located at the 6 o'clock position on the aft fan case.
(c)Connect plug P12 to the control alternator located on the accessory

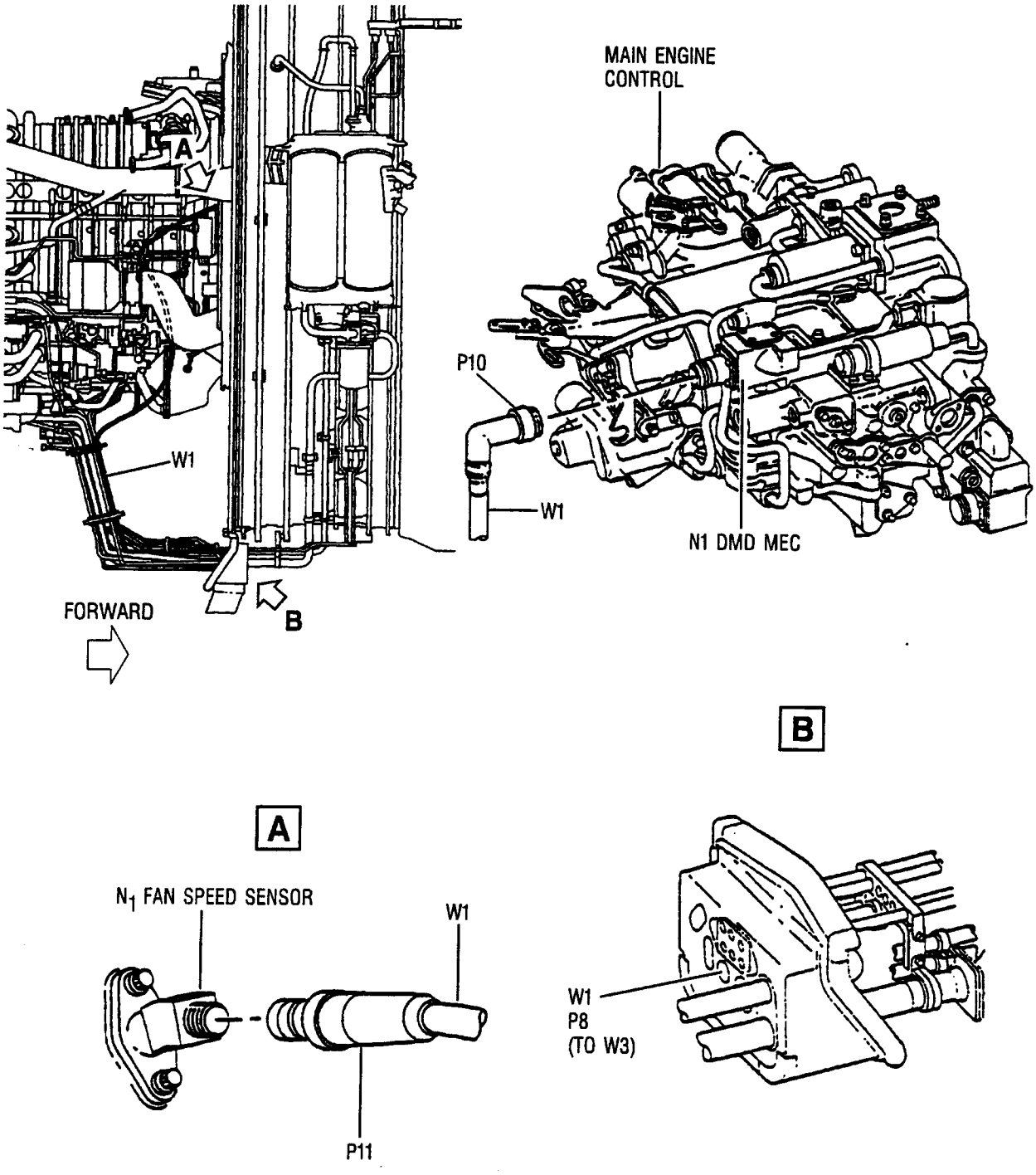
module.
(d)Install all loop clamps to support cable W-2.
(3)Installation of the W-3 cable (Ref. Fig. 401) (sheet 3/3).
(a)Remove all protective caps from the receptacles.
(b)Connect plug P3 to the T-12 sensor located on the forward fan case at the 11 o'clock position.
(c)Connect plug P6 to receptacle P8 and P7 to receptacle P9 on the pylon barrier assembly located on the aft fan case at the 6 o'clock position.
(d)Connect plugs P4 and P5 to the receptacles on the aircraft interface located on the forward fan case at the 7:30 o'clock position.
(e)Connect plug P1 to the receptacle on the PMC located on the aft fan case at the 7 o'clock position.
(f)Install all loop clamps to support cable W-3.

End Pre SB GE 72-405
Post SB GE 72-405
NOTE : SB GE 72-405 replaced the W1, W2 and W3 electrical cables with a single W1 cable.

C. Installation of the W1 Cable
(1)Installation of the W1 cable (Ref. Fig. 402, 403)
(a)Remove all protective caps from the connector receptacles.
(b)Connect connector P3 to the T12 sensor, located on the forward fan case at the 11 o'clock position (Ref. Fig. 403) (Sheet 3/3).
(c)Connect connectors P4 and P5 to the aircraft interface, located on the forward fan case at the 7:30 o'clock position (Ref. Fig. 403) (Sheet 3/3).
(d)Connect connector P1 to the PMC, located on the aft fan case at the 7 o'clock position (Ref. Fig. 403) (Sheet 3/3).
(e)Connect connector P12 to the control alternator, located on the accessory module (Ref. Fig. 403) (Sheet 2/3).
(f)Connect connectors P92 and P102 to the N1 fan speed sensor, located on the fan frame at the 2 o'clock position (Ref. Fig. 403) (Sheet 1/3).
(g)Connect connector P10 to the N1 DMD connection on the main engine control (MEC), located on the accessory module (Ref. Fig. 403) (Sheet 1/3).
(h)Install all necessary loop clamps to support the W1 cable.

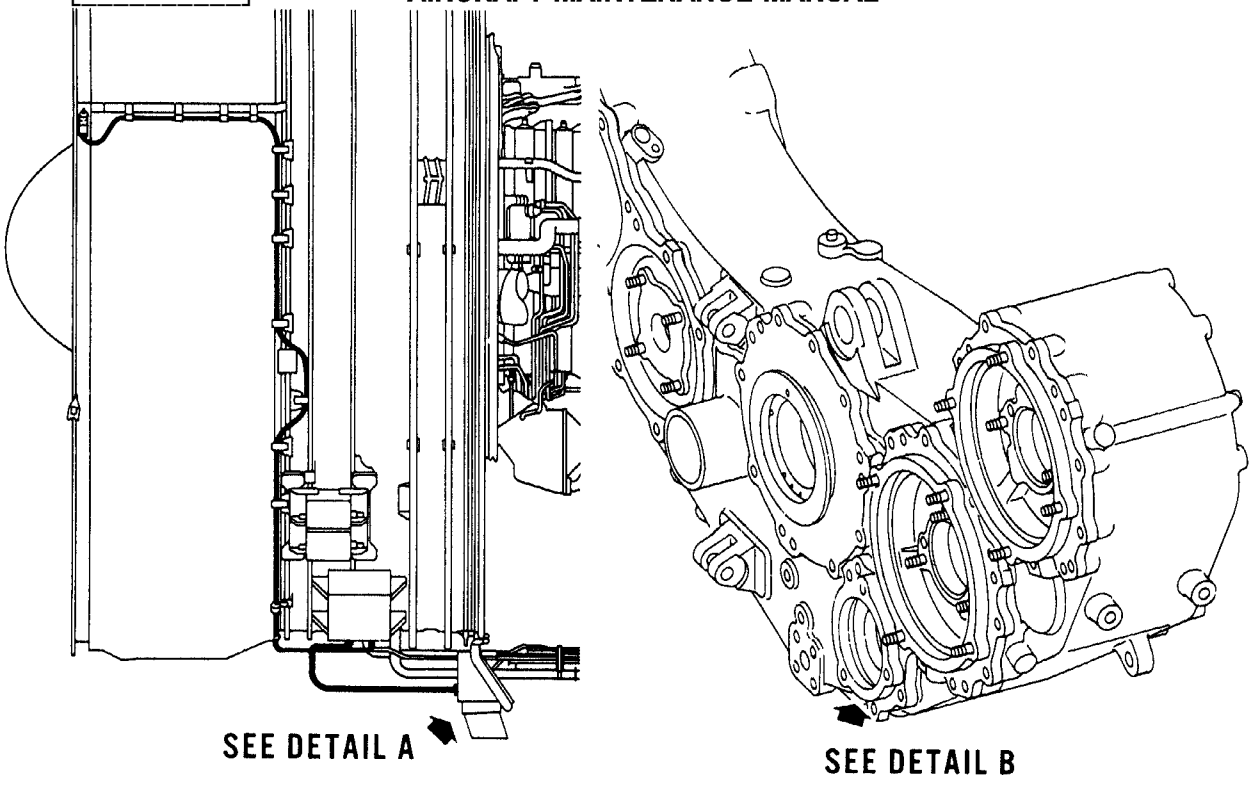
End Post SB GE 72-405

D. Close-Up
(1)Close cowl doors (Ref. 71-13-00, P. Block 301). Remove safety clips and
R tags and close related circuit breakers together with circuit breaker
R 4KS.

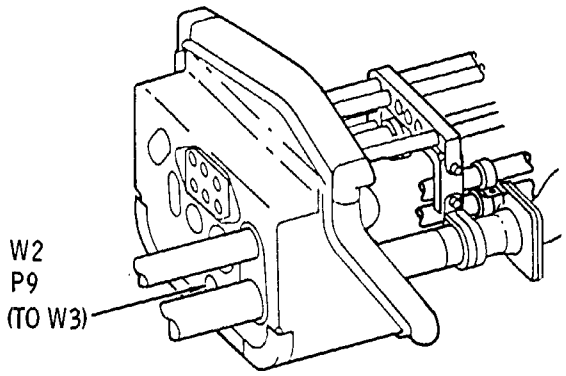


BM5 73 23 04 4 LAMA 01

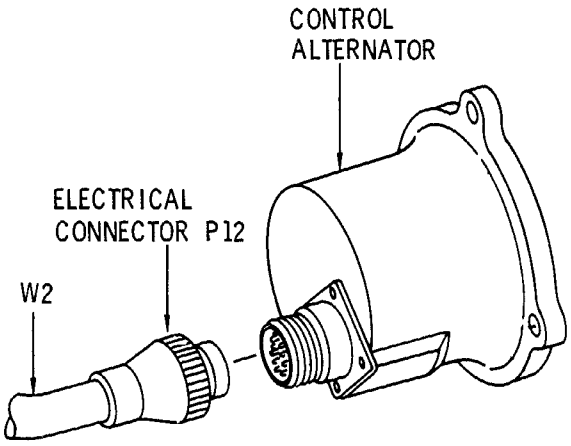
PMC Cable Installation (Pre SB GE 72-405) (Sheet 1/3)
Figure 401



DETAIL A



DETAIL B



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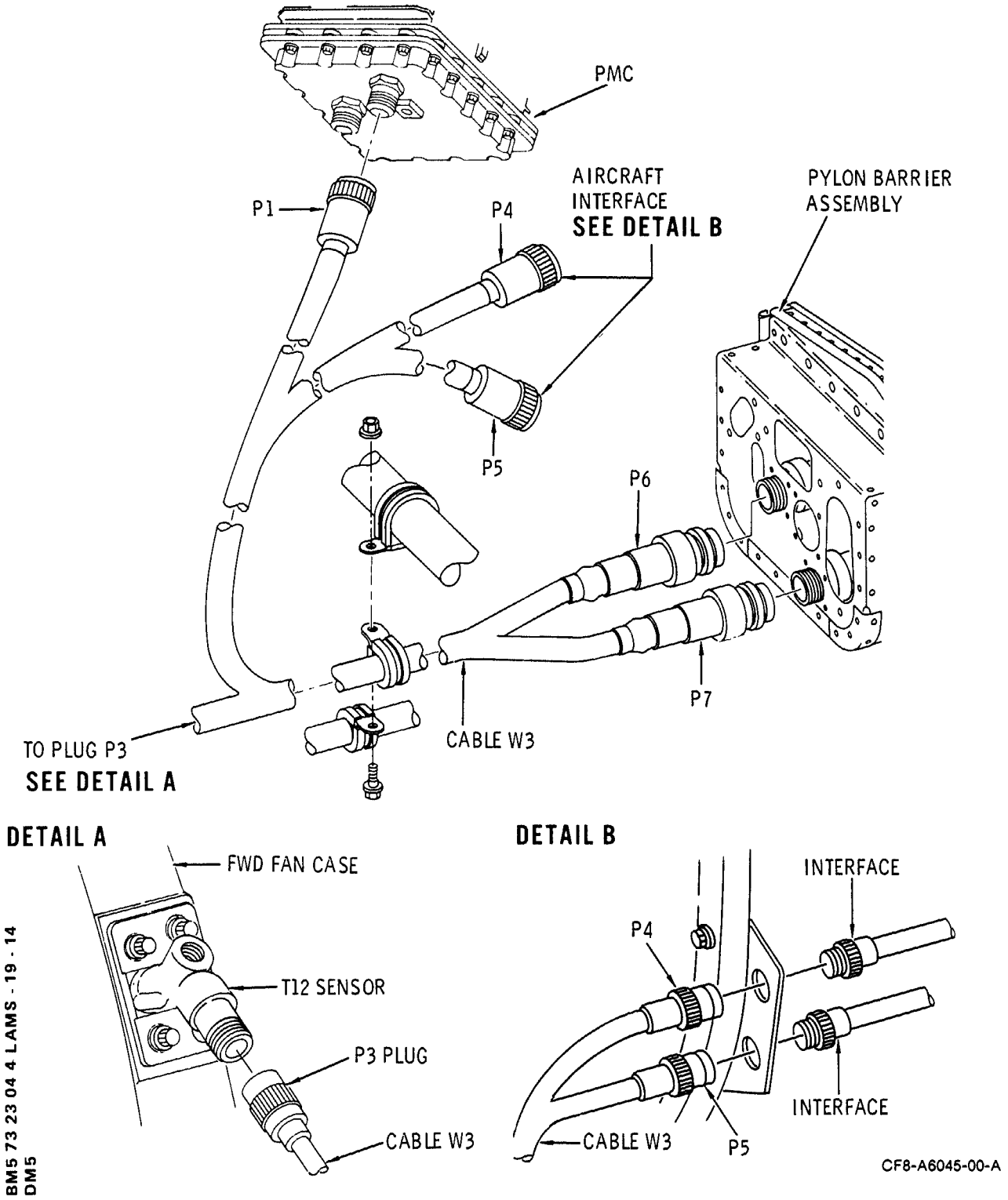
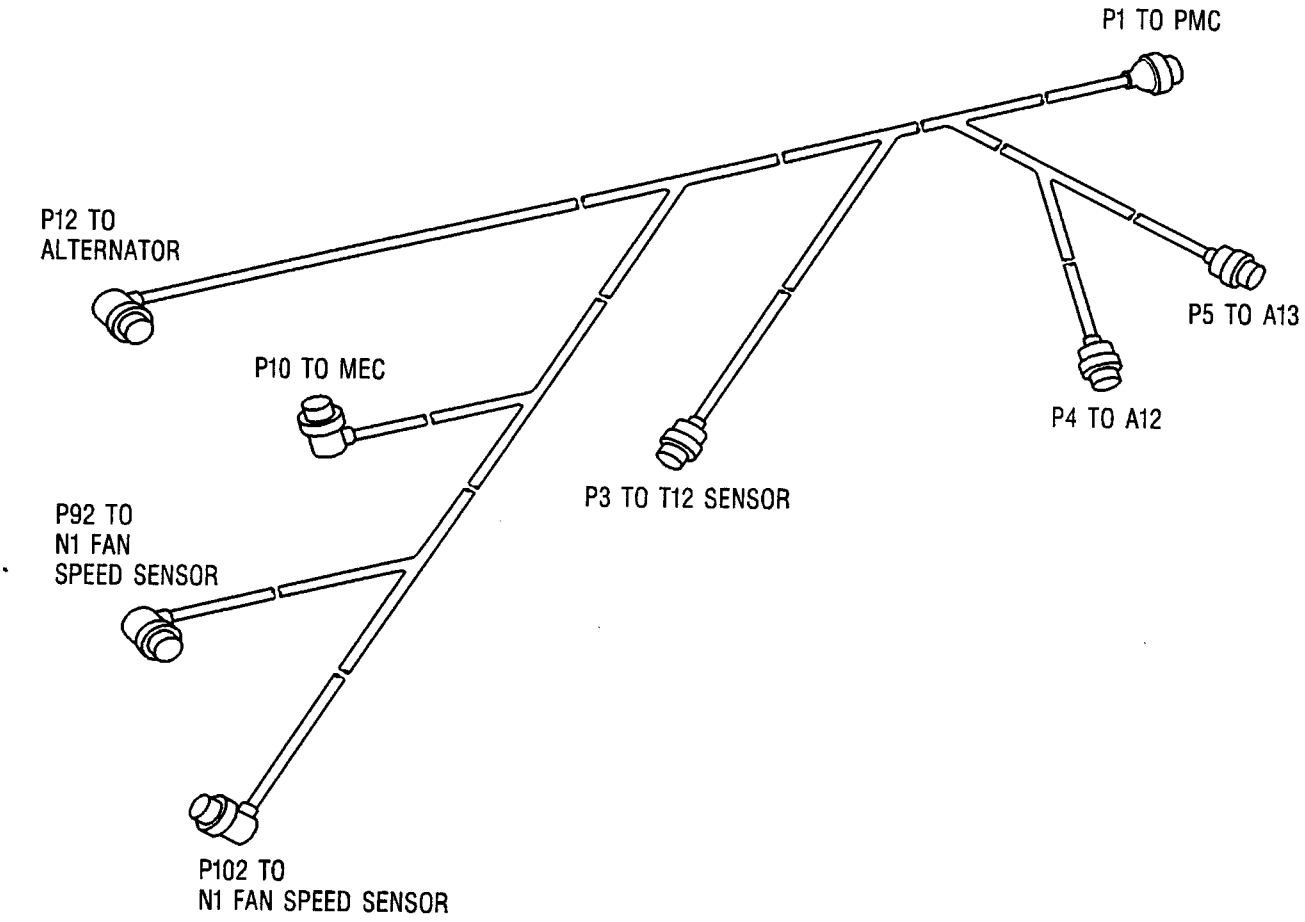
BM5 73 23 04 4 LAMJ - 19 - 14
DM5

PMC Cable Installation (Pre SB GE 72-405) (Sheet 2/3)
Figure 401

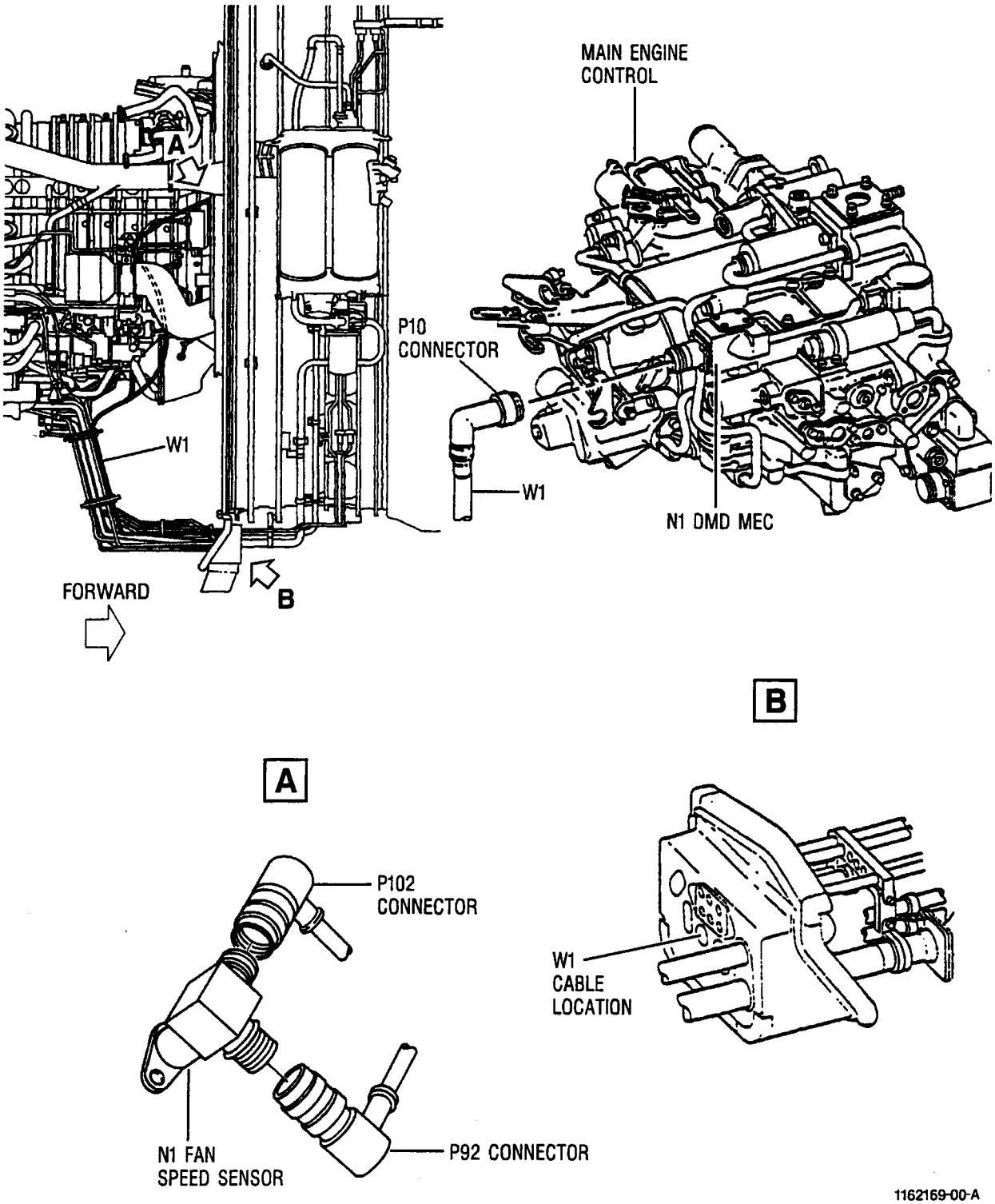


PMC Cable Installation (Pre SB GE 72-405) (Sheet 3/3)
Figure 401



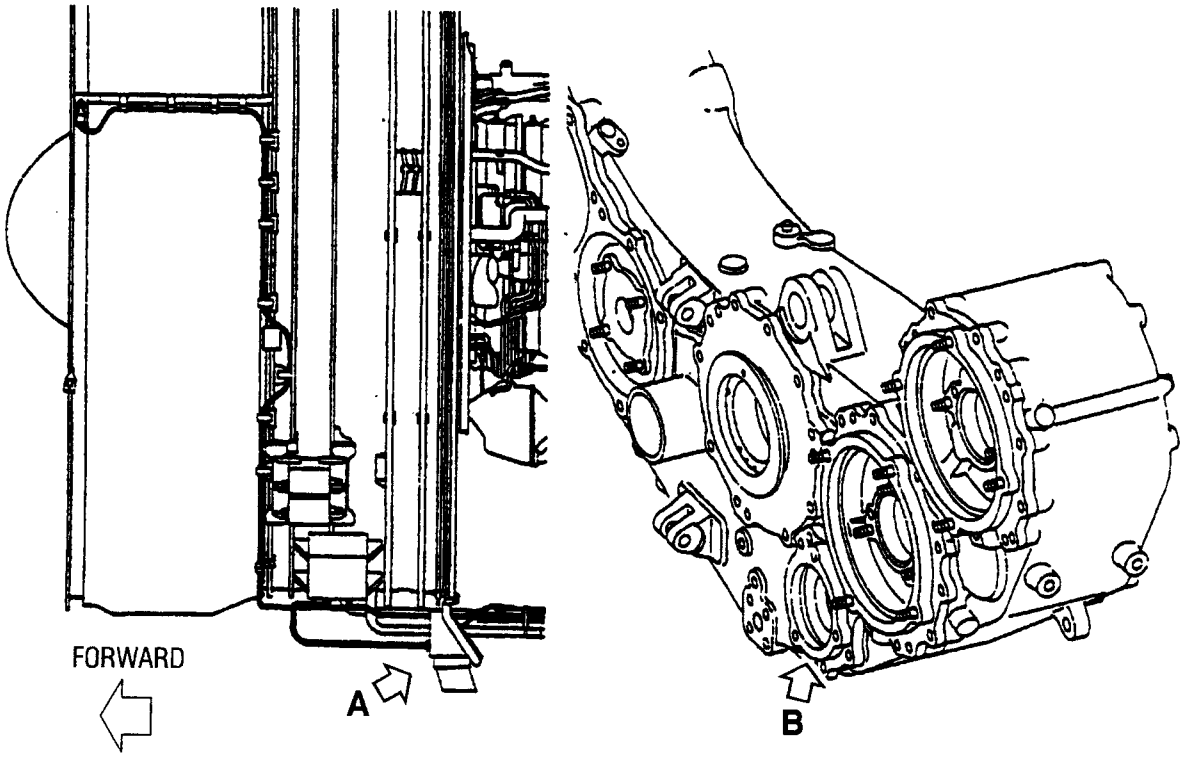
BM5 73 23 04 4 LCM0 00

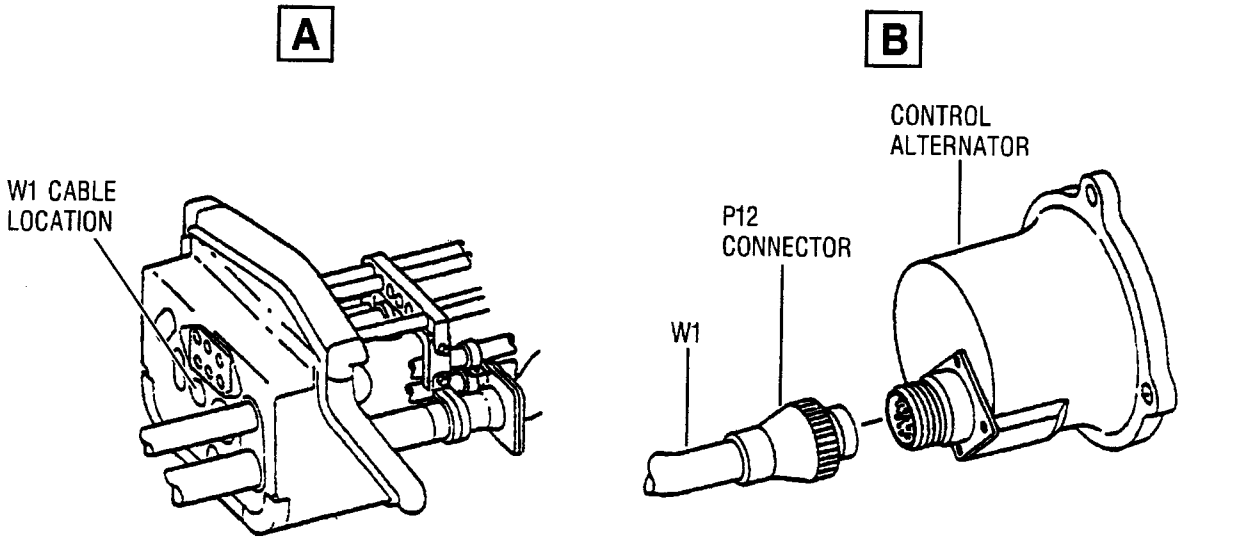
W1 Electrical Cable (Post SB GE 72-405)
Figure 402



BM5 73 23 04 4 LEMA 00

PMC Cable Installation (Post SB GE 72-405) (Sheet 1/3)
Figure 403

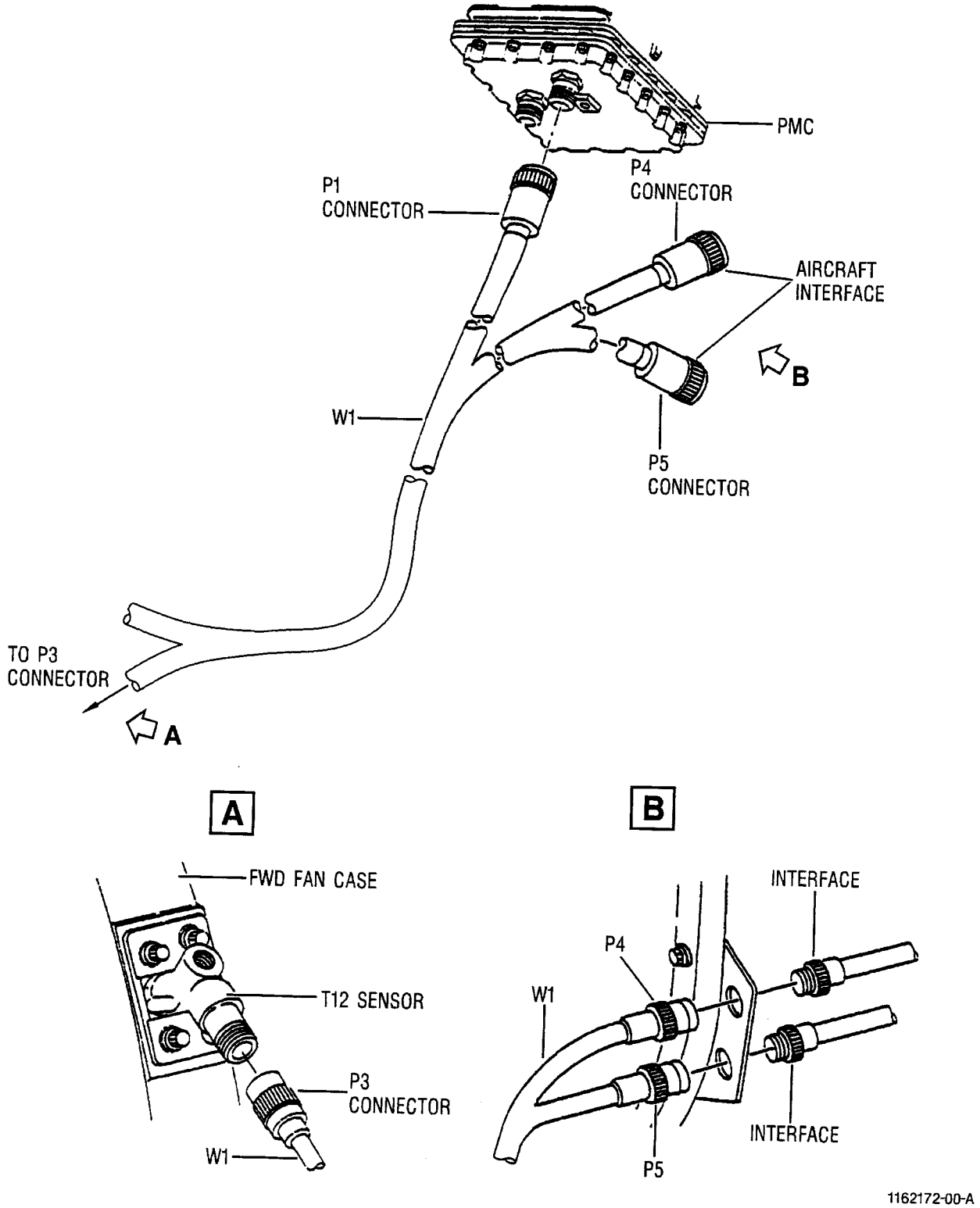




BM5 73 23 04 4 LEMJ 00

1162171-00-A

PMC Cable Installation (Post SB GE 72-405) (Sheet 2/3)
Figure 403



PMC Cable Installation (Post SB GE 72-405) (Sheet 3/3)
Figure 403

INLET TEMPERATURE SENSOR - REMOVAL/INSTALLATION

1. General

This procedure pertains to the removal and installation of the inlet temperature sensor. The sensor is mounted on the forward fan case at the 10 o'clock position, aft looking forward. Access to the sensor is gained by opening the left fan cowl.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Cap
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

3. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
21VU	ENG TRIM GND TEST	8KS	102/H13
22VU	AFS/ENG TRIM WARN	4KS	207/C21

(2)Open, safety and tag the appropriate circuit breakers, and open fan cowl doors (Ref. 71-13-00, P. Block 301).

B. Removal

Pre SB GE 73-097 (Ref. Fig. 401)
Post SB GE 73-097 (Ref. Fig. 402)

(1)Disconnect electrical connector from sensor.
(2)Remove grounding cable from the sensor.
(3)Remove 2 bolts and washers securing sensor mounting bracket to cable support brackets.
(4)Remove 4 bolts which secure sensor to fan case. Retain bracket and 4 dampers.
(5)Pull sensor from port in fan case, retain gasket.
(6)Install protective cap on electrical connector.

C. Installation of Sensor

(1)Place the gasket on the sensor and install the sensor into the mounting pad.

Pre GE SB 73-097 *** (ENGINES WITHOUT IMPROVED T12 SENSOR)

NOTE : The electrical receptacle on the sensor must face down towards the foward fan case's 9:00 o'clock position (aft locking foward).

End Pre GE SB 73-097

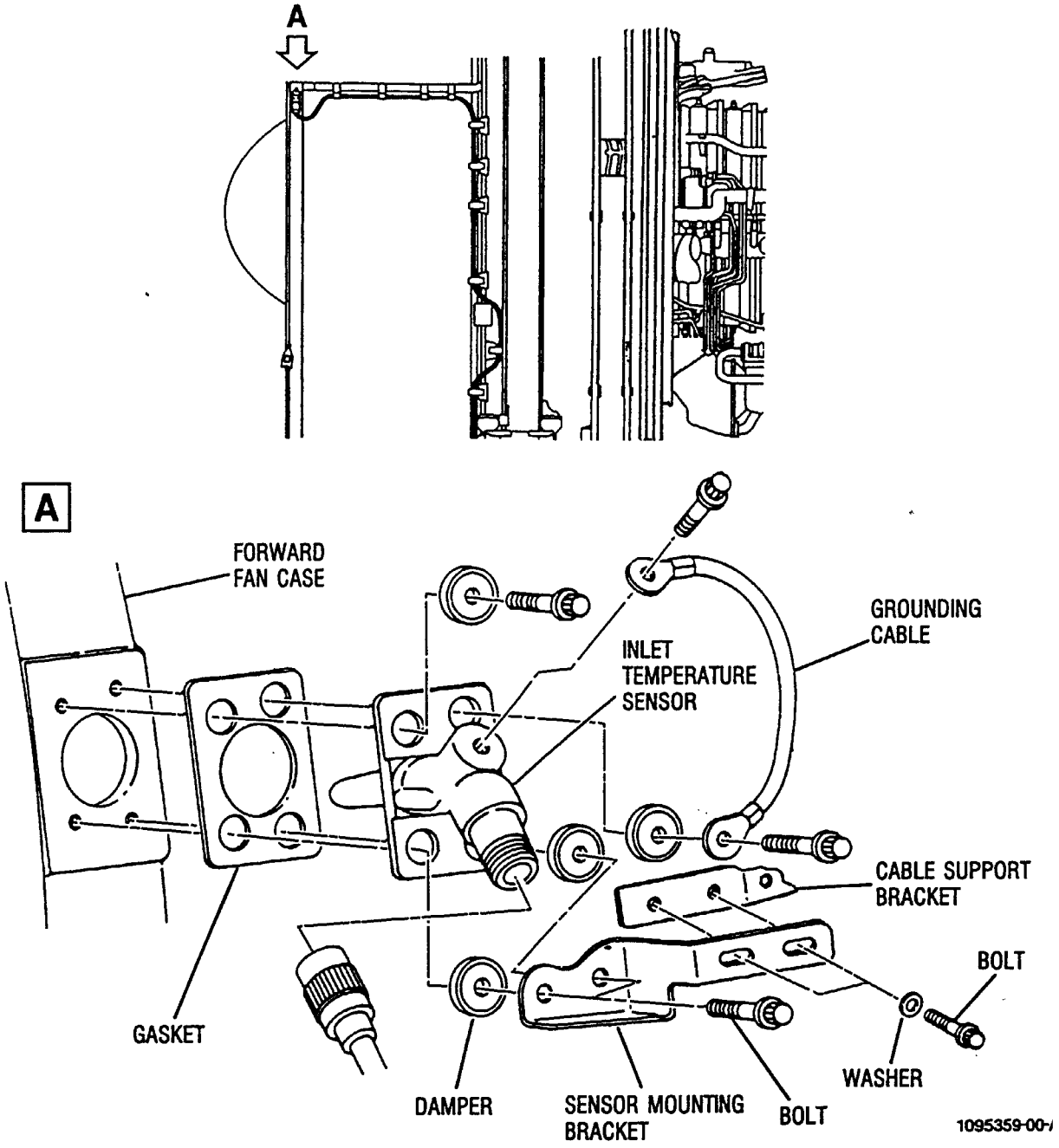
GE SB 73-097 *** (IMPROVED INLET TEMPERATURE (T12) SENSOR)

NOTE : The electrical receptacle on the sensor must face towards the aft section of the engine.

End GE SB 73-097

(2)Install the sensor mounting bracket over the bottom mounting holes between the 2 bolts and the 2 dampers.
(3)Secure the sensor at the upper holes to the fan case with 2 bolts and 2 dampers. The grounding cable is installed between the upper right damper and the bolt head.
(4)Attach the sensor mounting bracket to the cable mounting bracket with 2 bolts and 2 washers. TORQUE the bolts to between 55 and 70 lbf.in. (0.62 and 0.78 m.daN).
(5)TORQUE the 4 sensor mounting bolts to between 55 and 70 lbf.in. (0.62 and 0.78 m.daN).
(6)Install the grounding cable to the sensor with 1 bolt. TORQUE the bolt to between 55 and 70 lbf.in. (0.62 and 0.78 m.daN).
(7)Insert the electrical connector in the sensor's electrical receptacle.

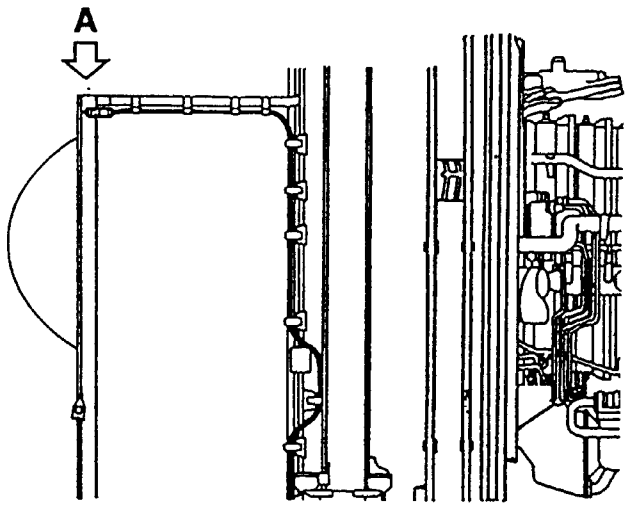
D. Close-Up
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Close fan cowl doors. Remove safety clips and tags and close the appropriate circuit breakers (Ref. 71-13-00, P. Block 301), together with circuit breakers 8KS and 4KS.

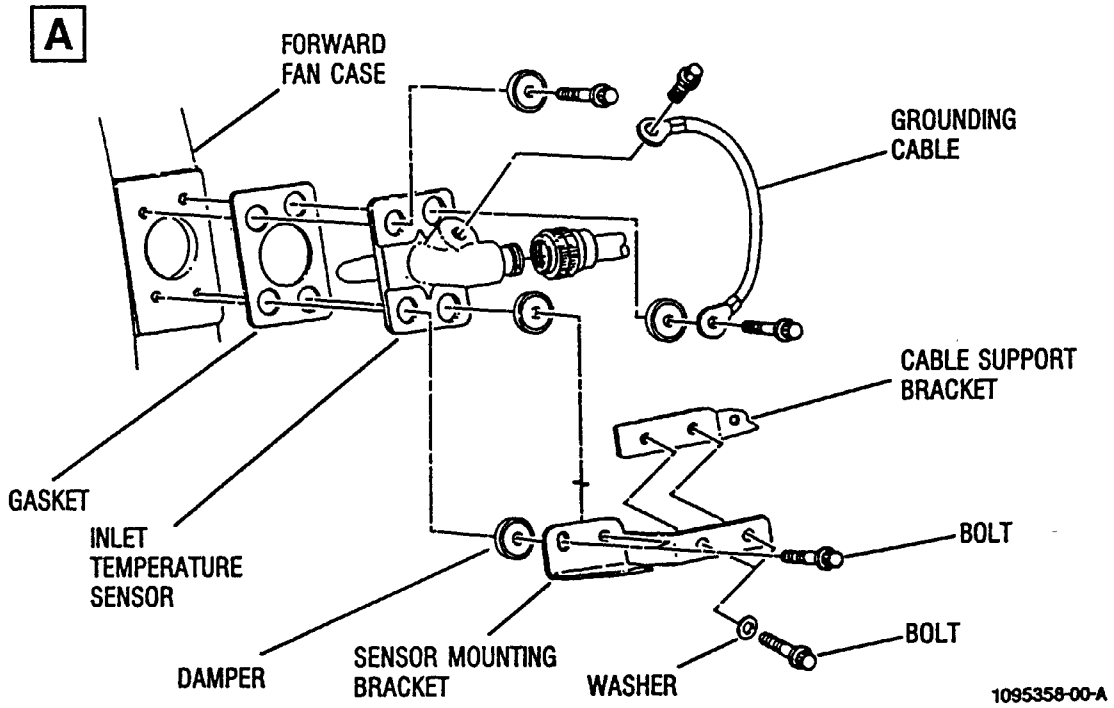


BM5 73 23 06 4 LAMO - 01

Inlet Temperature Sensor
Figure 401

GE SB 73-097





BM5 73 23 06 4 LANO - 00

Inlet Temperature Sensor
Figure 402

FAN INLET TEMPERATURE SENSOR - REMOVAL/INSTALLATION

1. General

This procedure pertains to the removal and installation of the Fan Inlet Temperature Sensor (T2 H/M). The sensor is mounted to a bracket on the fan case at approximately the 2 o'clock position (aft looking forward.)

2. Equipment and Materials

ITEM	DESIGNATION
A.	Container
B.	Circuit Breaker Safety clips
C.	Caps and Plugs
D.	Torque Wrench 0-150 lbf.in. (0 - 1.69 m.daN)
E.	Torque Wrench 0-600 lbf.in (0 - 6.78 m.daN)
F.	Access Platform
G. Material No.C02-021	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
H. Material No.C05-005	Inspection and Marking Compounds (Ref. 70-00-00)
Referenced Procedures	
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors

3. Procedure

A. Job Set-Up
  (1)Open, safety and tag circuit breakers for the appropriate engine and open fan cowl doors (Ref. 71-13-00, P. Block 301).
  (2)Install access platform.

B. Removal (Ref. Fig. 401)
  (1)Disconnect drain tubes from P7 and PB drain cans.
  (2)Remove lockwire and disconnect drain cans from sensor P7 and PB ports. Remove and discard packings.
  (3)Position container under fuel tubes to catch residual fuel and disconnect P7 and PB fuel tubes from sensor.
  (4)Disconnect 4 hinged loop clamps securing sensor capillary tube to fan case bracket by turning bolts one-quarter turn CCW and opening clamps.
  (5)Remove 4 bolts and 2 washers securing support bracket, probe, gasket, and 4 dampers to fan case. Retain bolts and washers for installation.
  (6)Remove 2 bolts, washers, and nuts securing sensor mounting bracket and sensor; retain bolts, washers, and nuts for installation.
  (7)Remove support bracket, fan case bracket, with clamps attached, and sensor mounting bracket, as a single unit.
  (8)Remove 2 bolts, spacers, and nuts securing sensor to fan case split-line. Retain bolts, spacers, and nuts for installation.

(9)Remove sensor, capillary tube, probe, gasket, and 4 dampers, as a single unit.
(10)If replacing sensor, remove the following:
(a)Four grommets from sensor capillary tube; retain grommets for installation, if not damaged.
(b)Probe gasket and 4 dampers; retain gasket and dampers for installation, if not damaged.

C. Installation (Ref. Fig. 401)
NOTE : Fuel components that have Fluorocarbon (Viton) external seals (SB 73-079) can leak for a short period of time when they are below -29°F (-34°C). If a leak occurs, continue the start to idle.
- If the fuel leakage stops in less than 5 minutes at idle, continue operation of the engine.
- If the fuel leakage continues after 5 minutes at idle, shut down the engine and repair the source of the leakage.

(1)If installing a new sensor, install the following:
(a)Probe gasket and 4 dampers. Ensure that each damper is installed, large end up, through bolthole in probe and gasket. See section A-A (Ref. Fig. 401).
(b)Four grommets on sensor capillary tube.
(2)Position sensor, capillary tube, probe, gasket, and 4 dampers, as a single unit, on fan case.
NOTE : Probe air vent holes must be facing forward.
(3)Secure sensor to fan case split-line with 2 bolts, spacers, and nuts; tighten nuts fingertight.
(4)Position support bracket, fan case bracket, with clamps attached, and sensor mounting bracket, as a single unit, on fan case.
(5)Secure sensor mounting bracket and sensor to fan case flange with 2 bolts, washers, and nuts. TORQUE nuts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
(6)TORQUE 2 nuts securing sensor to fan case split-line to between 140 and 155 lbf.in. (1.58 and 1.75 m.daN).
(7)Secure lower part of probe, gasket, and 2 dampers to fan case with 2 bolts and washers.
(8)Secure upper part of probe, support bracket, gasket, and 2 dampers to fan case with 2 bolts.
(9)TORQUE probe mounting bolts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
(10)Connect 4 hinged loop clamps securing sensor capillary tube to fan case bracket; align grommets on capillary tube with clamps, close clamps, and tighten by turning bolts one-quarter turn CW.
(11)Lubricate 2 new packings with oil (C02-021) and install one packing in each knurled nut on drain cans.
(12)Connect P7 and PB fuel tubes to sensor. TORQUE tube B-nuts to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).
(13)Perform leak check as follows :
(a)Remove caps on T-fittings below Fan Inlet Temperature Sensor.
(b)Connect dry nitrogen supply lines to the T-fittings on the PB and P7 fuel tubes.
CAUTION : DO NOT EXCEED A PRESSURE OF 200 PSIG (1379 kPa GAGE).

PRESSURE SHOULD BE APPLIED SIMULTANEOUSLY TO BOTH THE PB AND P7 PORTS TO PREVENT DAMAGE TO SENSOR.

(c)Pressurize both manifold ports to 200 psig (13.79 bars) with dry nitrogen.

(d)Apply Leak-tek (C05-005) or a soap solution to both PB and P7 tube connections at the sensor. No leakage is allowed.

(e)If a leak exists, loosen the coupling nut and inspect condition of union. If union is not damaged, retighten nut and recheck for leakage. If union is damaged, replace union and repeat check.

(f)Disconnect nitrogen supply lines from the T-fittings on the PB and P7 fuel tubes and install caps on the T-fittings. TORQUE caps to between 135 and 150 lbf.in. (1.52 and 1.69 m.daN).

(14)Connect knurled nuts of drain cans to sensor P7 and PB ports; hand-tighten and wirelock.

(15)Connect drain lines to drain cans. TORQUE drain line B-nuts to 135 and 150 lbf.in. (1.52 and 1.69 m.daN).

(16)Perform drain can leak check as follows :

(a)Disconnect drain tube at male end, just below Y-connection.

(b)Connect a dry nitrogen supply line to the drain tube and pressurize the fuel tube drain cans to 50-55 psig (3.45-3.79 bars).

(c)Monitor pressure for 2 minutes. A maximum pressure decrease of 10 psig (0.69 bars).

(d)If limit is exceeded, inspect for leakage around drain cans with Leak -Tek (C05-005) or a soap solution. No leaks permitted.

(e)Tighten knurled nuts by hand to stop leaks. If leakage continues, replace preformed packings.

(f)Disconnect nitrogen supply and reconnect drain lines. TORQUE drain line coupling nut to between 135 and 150 lbf.in. (1.52 and 1.69 m.daN).

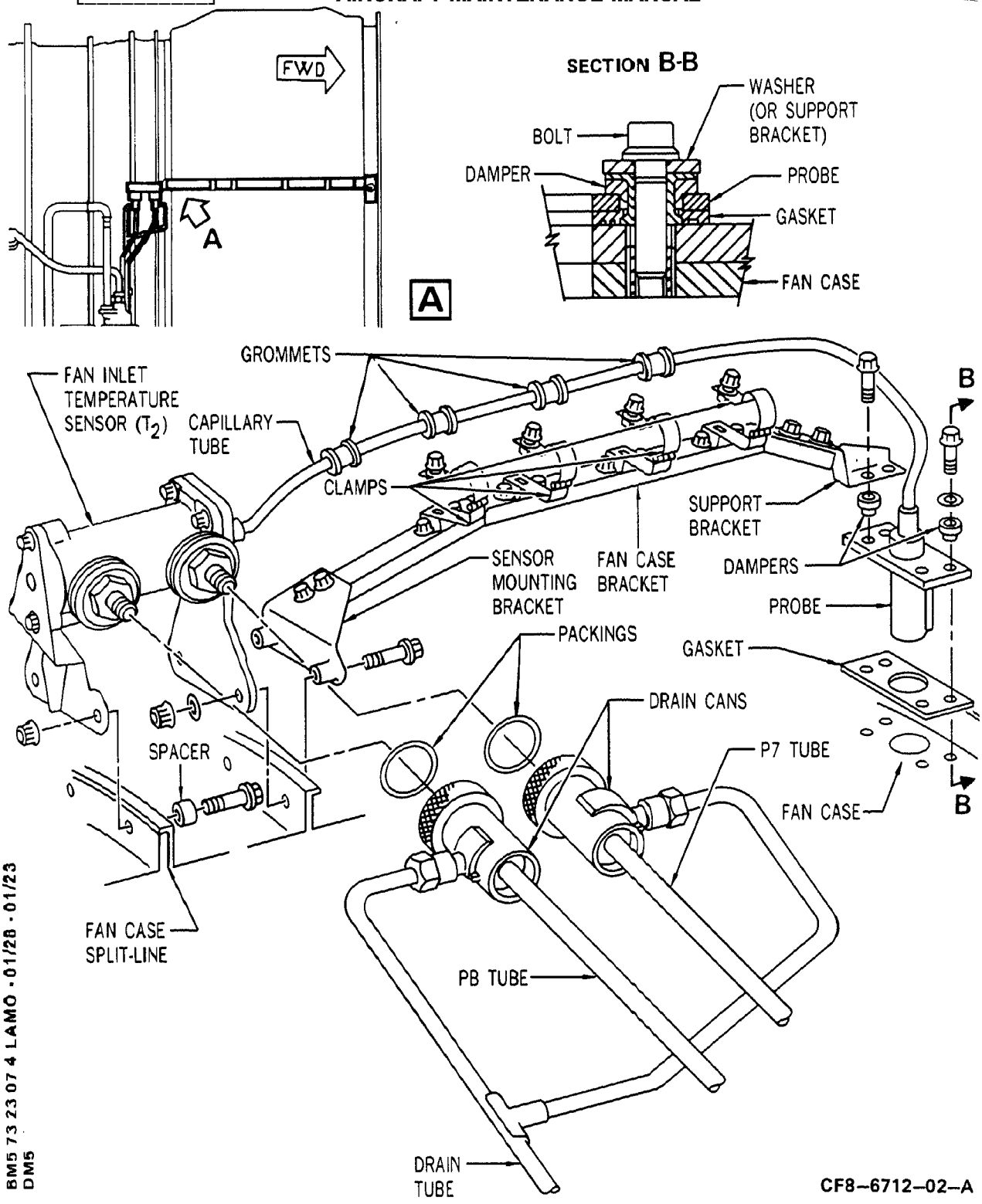
D. Close-Up and Test

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2)Remove access platform.

(3)Close fan cowl doors. Remove safety clips and tags and close the appropriate circuit breakers (Ref. 71-13-00, P. Block 301).

(4)Perform test as indicated in "Type of testing after engine component replacement" (Ref. 71-00-00, P. Block 501).



Fan Inlet Temperature Sensor - Removal/Installation
Figure 401

FAN INLET TEMPERATURE SENSOR - INSPECTION/CHECK

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the appropriate circuit breakers and open fan cowl doors (Ref. 71-13-00, P. Block 301).

B. Inspection/Check

INSPECT/CHECK	MAXIMUM SERVICEABLE LIMITS	REMARKS
(1)Housing for :		
(a)Cracks	Not serviceable	Replace sensor
(b)Nicks and scratches	Any number, any size	Remove high metal
(c)Dents	Any number, provided no deformation which could cause internal seizure	Replace sensor
(2)Fittings for :		
(a)Cross-threaded threads	Not serviceable	Replace sensor
(b)Deformed threads	Not serviceable	Replace sensor
(c)Cracked threads	Not serviceable	Replace sensor
(d)Nicks, dents, scores on sealing surface	Not serviceable	Replace sensor
(e)Cracked sealing surface	Not serviceable	Replace sensor
(3)Mounting Flange for :		
(a)Cracks	Not serviceable	Replace sensor
(b)Bent or distorted	Not serviceable	Replace sensor

C. Close-Up

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Close fan cowl doors. Remove safety clips and tags and close the appropriate circuit breakers (Ref. 71-13-00, P. Block 301).

1. General

(Ref. Fig. 001)

(Ref. Fig. 002)

The engine fuel system is monitored from :

- the **FF/FU** indicator which displays the dual indication : fuel flow/fuel used
- the aural warning associated with **FUEL CLOG** caution light (comes on amber) and **MASTER CAUTION** light (flashes).
- the engine page which can be displayed on the **R ECAM** display unit and which provides the fuel pressure for each engine.

These indications appear on center instrument panel **4VU** and on **CAPT (F/O)** main instrument panels **3VU (5VU)**.

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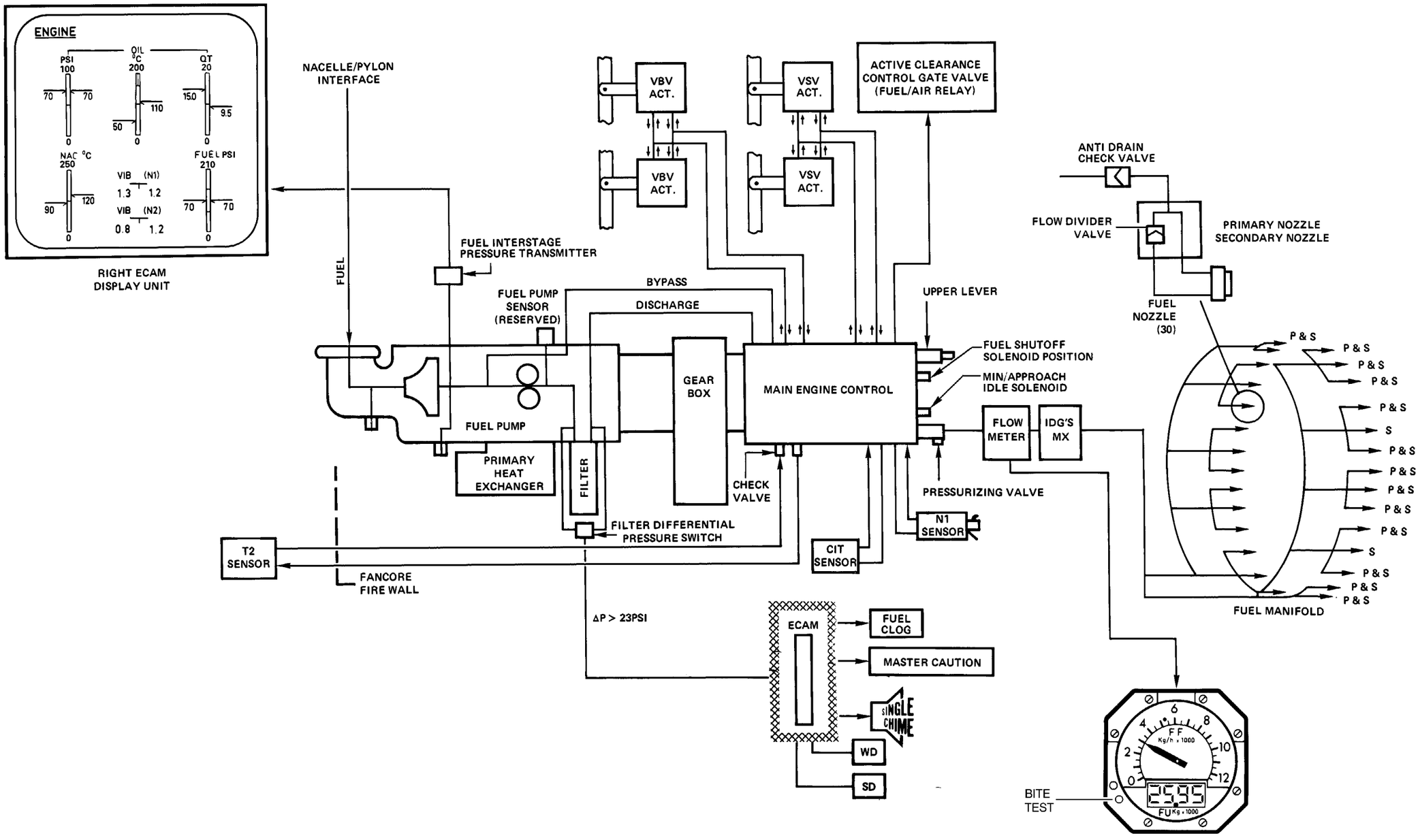
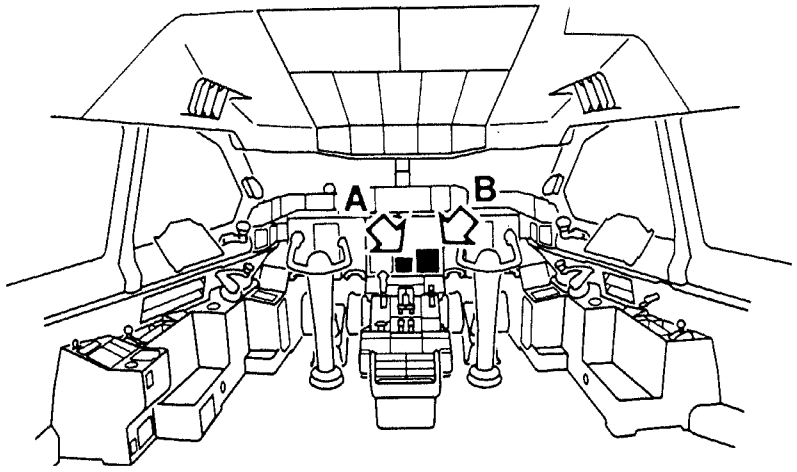
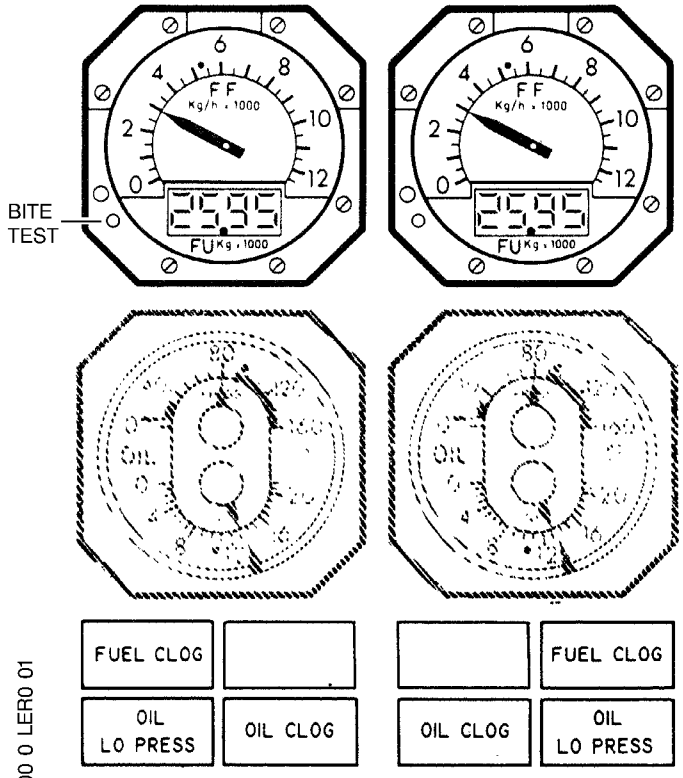
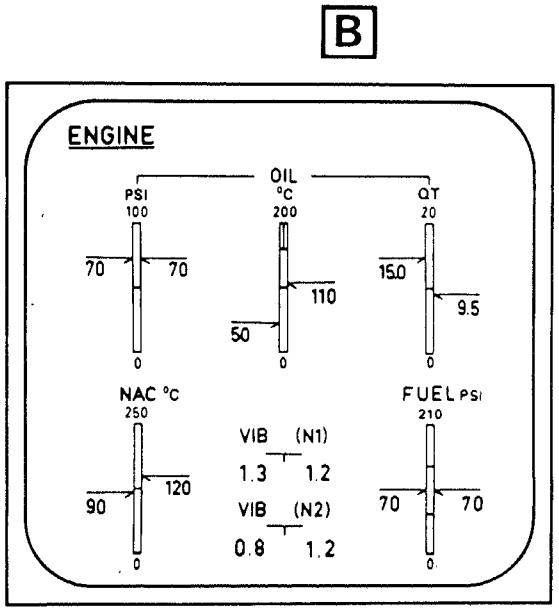


Fuel System Schematic
Figure 001







ENGINE PAGE

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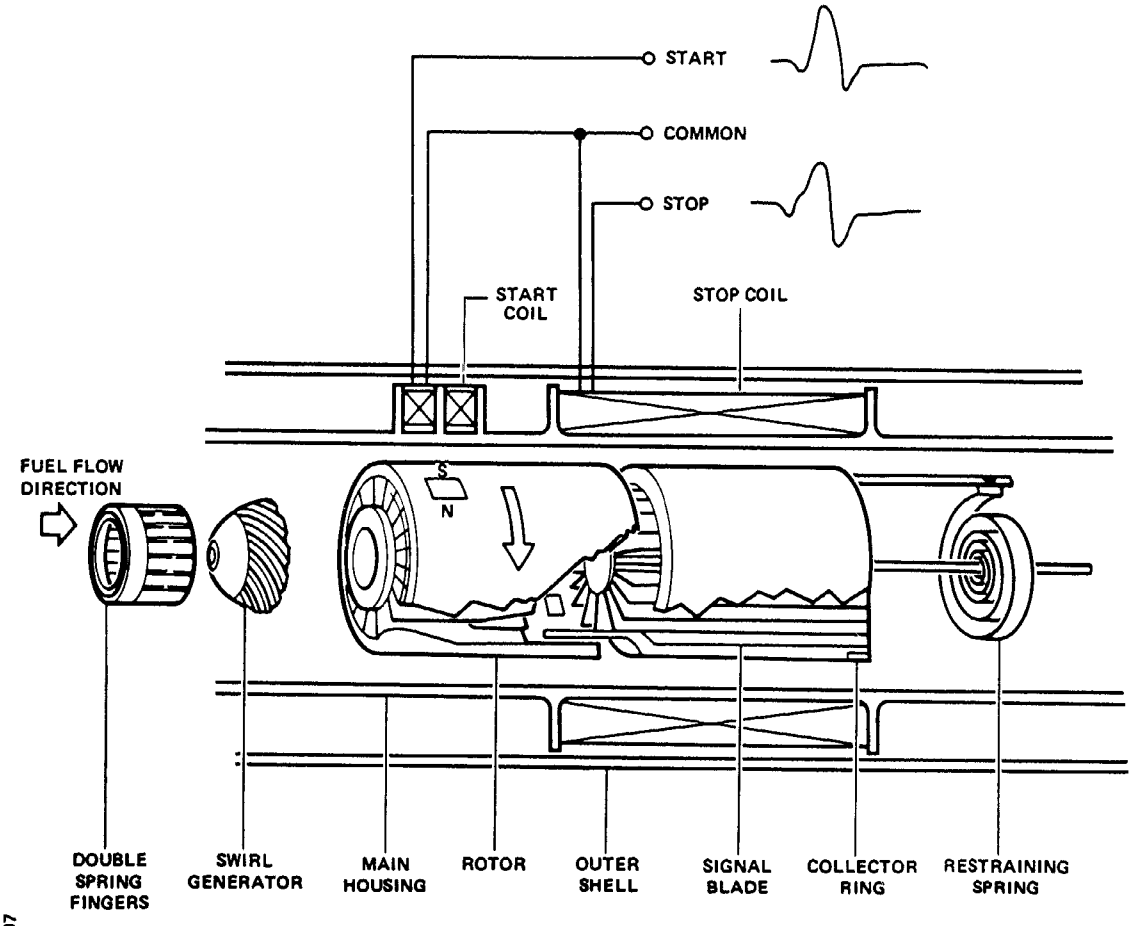
Fuel Indicating
Figure 002

R

FUEL FLOW INDICATING - DESCRIPTION AND OPERATION

1. Fuel Flow Transmitter (Ref. Fig. 001)
   The fuel flow transmitter is mounted at 4 o'clock on the engine next to the accessory gearbox and does not require an electrical power input. The operating principle is to create a vortex fuel flow that drives the rotor. The fuel flows across a turbine equipped with a return spring which counteracts the torque resulting from the fuel flow. The turbine angular setting varies so that the return spring torque balances the fuel rotation moment. This provides measurement of fuel mass flow.
   At each rotation two permanent magnets mounted on the rotor and the turbine pass in front of two coils and generate two pulses.
   The lapse of time between these two pulses enables direct measuring of the mass fuel-flow.



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Fuel Flow Transmitter - Schematic
Figure 001

2. FF/FU Indicator
(Ref. Fig. 002)
(Ref. Fig. 003)
The fuel flow/fuel used indicator is located on center instrument panel 4VU.
It is supplied with 115VAC - 400Hz.
An electronic unit is located inside the indicator ; the electronic unit processes the ΔT of pulses and supplies the fuel flow pointer and the fuel used counter. (ΔT = 150 ms for a flow of 12247 kg/h i.e. 82 kg/h by m/s). The fuel flow fuel used indicator provides the following information.

A. The Analog Display of the Fuel Flow :
this indication is given by means of a pointer which moves on a dial graduated from 0 to 12500 Kg/h.
Displacement of this pointer is ensured by the signal transmitted by the indicator electronic unit.
In the event of electrical power loss in the indicator, the pointer will return to the lower stop and will partially mask the counter.
In the event of fault detection by the indicator internal monitoring circuit, the pointer will move to the lower stop and will mask the counter.

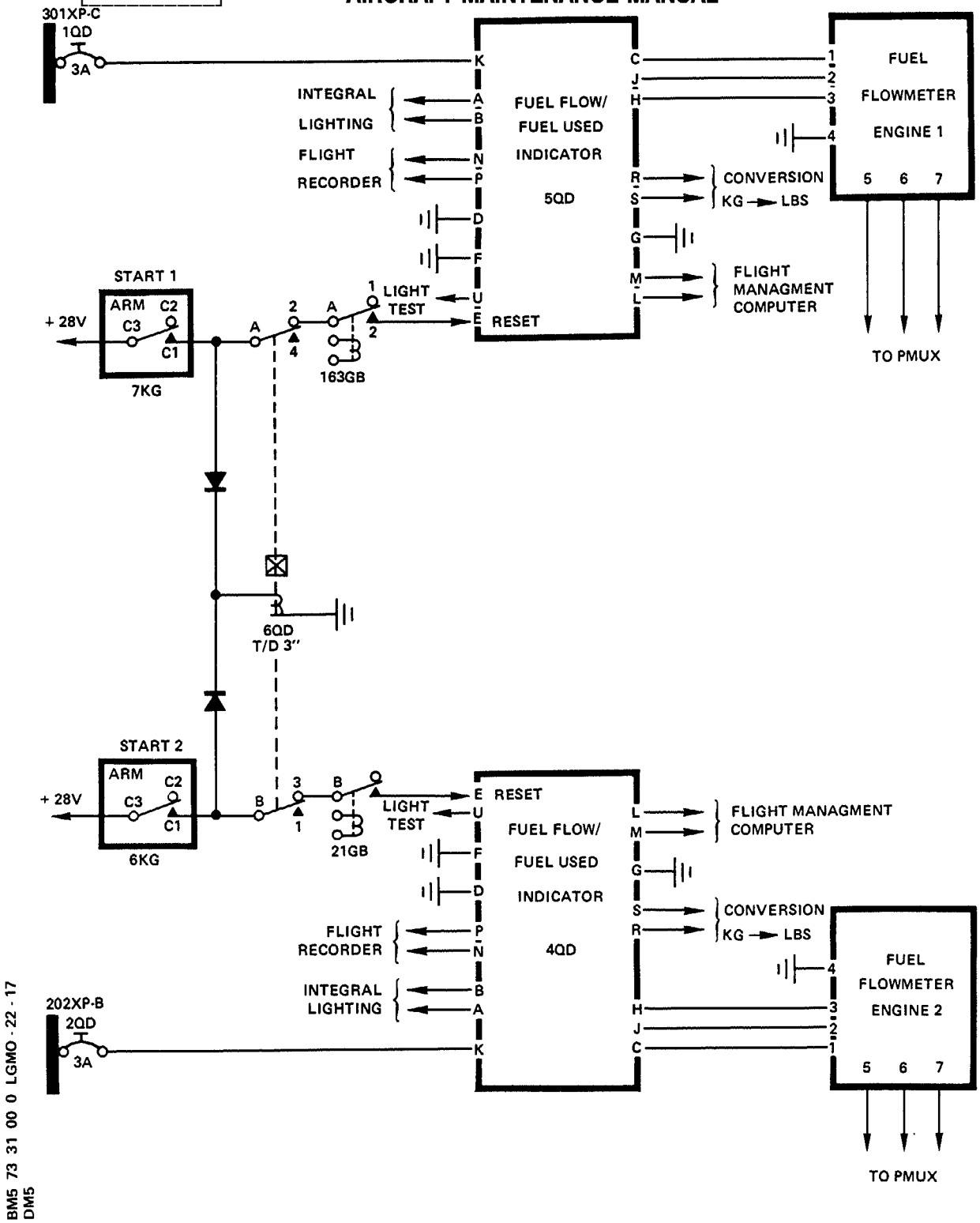
B. Digital Display of Fuel Used Information
This is achieved by static display; the values (0 to 99990 kg) displayed cannot be transmitted; the display window is located at the lower part of the indicator.
The display indicator is activated by the electronic unit of the FF/FU indicator. In the event of electrical power loss in the indicator the static display will be black.
The fuel used information will be stored for any 10 second power supply cut out.
Fuel used indicator is automatically reset to zero when the engine is started on ground.
(Ref. Fig. 004)

C. Analog Output
Analog output (0-5 VDC) of the fuel flow information (by ARINC 717 towards the DFDAU (Ref. 77-31).

D. Digital Output
Digital output by ARINC 429 for the fuel flow information (label 347) to be utilized by the flight management computer (FMC).

E. Reset to Zero of the Fuel Used Counters
The fuel used counters will be reset to zero when the captain presses ENG START/START 1 (2) pushbutton switch on panel 429VU, on flight compartment overhead panel.
On ground, when the START 1 (2) pushbutton switch is pressed, relay 6QD is energized, and the circuit is closed for 3 seconds which causes the fuel flow counters to be reset to zero.

F. Change of Unit
Change of unit is possible on the indicator by shunting terminals R and S



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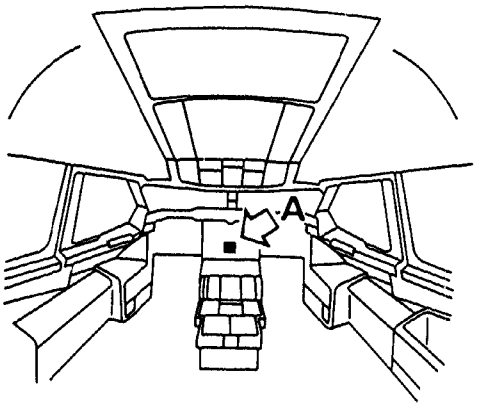
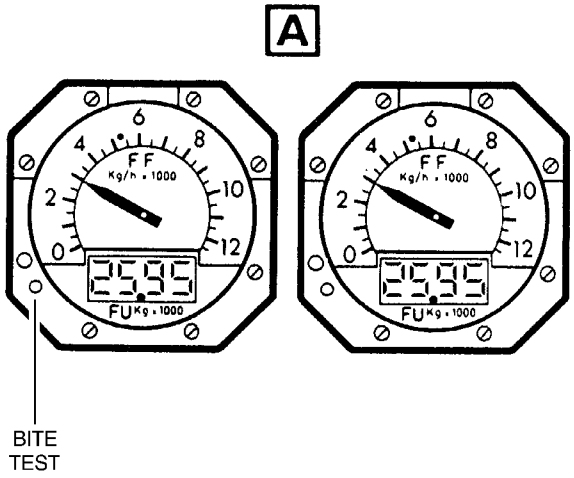
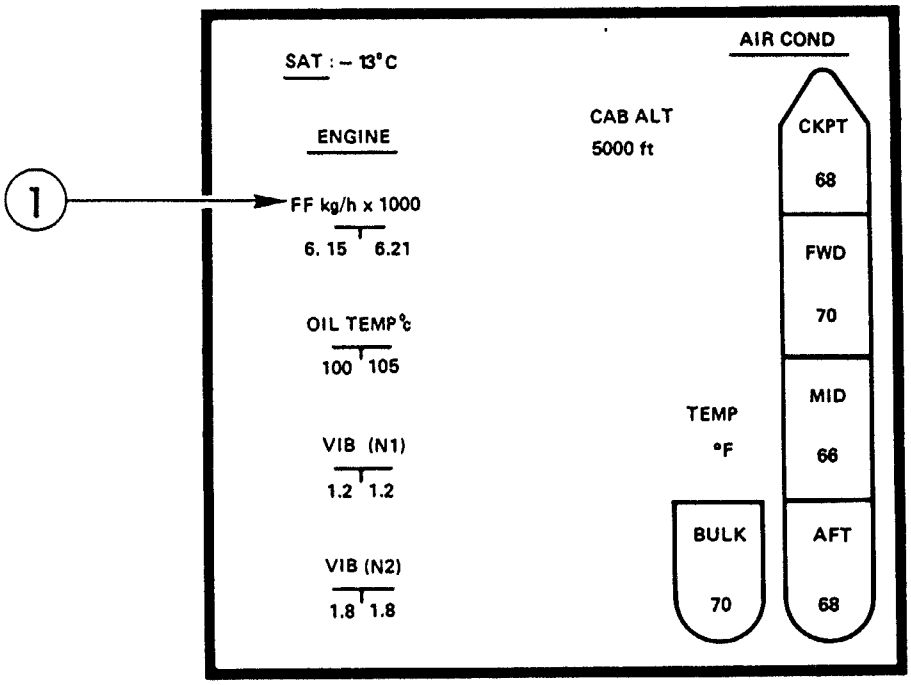
Fuel Flow/Fuel Used Electrical Circuit
Figure 002





R

Fuel Flow Indicators
Figure 003



CRUISE PAGE

1 - FUEL FLOW

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Cruise Page
Figure 004

and by changing the dial. When the shunt is open, the unit is kg/h ; if the shunt is closed, the unit is lb/h.

G. Test Function

R This function is ensured by a bite test located at the lower part of the indicator.

R When this bite test is pressed a switch which supplies the pointer is energized ; the pointer moves to the blue spot on the dial (FF = 5400 kg/h).

R When the bite test is released, the pointer returns to zero.
This device is only used for maintenance purposes.

H. Display Unit Function Test

The indicator being energized, and receiving the **TEST** signal via the **ANN LT** system, the test is as follows :

- all the 8 figures are in view.

FUEL FLOW - INDICATING - ADJUSTMENT/TEST

1. Reason for the Job

The test consists in checking fuel flow indication circuit.

2. Equipment and Materials

ITEM	DESIGNATION
Referenced Procedures	
- 24-41-00, P. Block 301	AC External Power Control
- 71-00-00, P. Block 501	Power Plant

3. Procedure

A. Job set-up

(1)Initial conditions

- Circuit breakers closed, particularly those associated with **ENGINES.**
- Correct electrical power supply.
- Forward services ventilation system in operation.

(2)Make certain that when **"BITE"** pushbutton switch located at the lower section of the indicator is pressed, the pointer moves to the blue spot on the dial and indicates 5400 Kg/h.

B. Functional Test

ACTION	RESULT
1. Wet motor engine (Ref. 71-00-00, P. Block 501).	On panel 4VU - the fuel used counters are reset to zero when during wet motoring procedure **ARM SEL** pushbutton switch is pressed on panel 429VU - the fuel flow indication increases normally.

C. Indicator Test

ACTION	RESULT
1. On panel 4VU, R - maintain slote of **BITE** screw or R Press-To-Test button, located in R L lower of FF/FU indicator or R pressed in, respectively.	The fuel flow pointer moves to indicate a fuel flow value of 5400 Kg/Hr (12,000 PPH) marked by the blue spot on the edge of the dial face.

D. Close-up

(1)De-energize the aircraft electrical network (Ref. 24-41-00, P. Block 301).

(2)Restore system and aircraft to normal operating condition.

FUEL FLOW TRANSMITTER - REMOVAL/INSTALLATION

1. General

A. Access to the fuel flow transmitter is through the right fan reverser cowl door.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Protective Caps
C.	Torque Wrench 55 - 70 lbf.in. (0.62 - 0.79 m.daN)
D. Material No.C02-021	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
E. Material No.C02-023	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 71-00-00, P. Block 501	Power Plant-Engine

3. Procedure

A. Job Set-Up

(1)Open, safety and tag the circuit breakers for the appropriate engine and open fan cowl and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

Pre SB GE 73-085 R2 *** (NO SPRAY SHIELDS ON THE FUEL FLOW TRANSMITTER)

B. Removal (Ref. Fig. 401)

CAUTION : FUEL FLOW TRANSMITTERS THAT WILL BE SHIPPED FOR REPAIR OR NOT RE-INSTALLED WITHIN 24 HOURS, MUST BE PRESERVED TO PREVENT INTERNAL CORROSION.

(1)Disconnect electrical connector from transmitter and install protective cover on connector.
(2)Remove bolts and washers attaching tubes and angle brackets to transmitter.
(3)Remove the four bolts that attach the fuel inlet tube to the MEC. Remove the gasket and the fuel inlet tube.
(4)Position a suitable container under transmitter and allow residual fuel in tubes to drain.
(5)Remove bolts and washers securing strap and transmitter to accessory gearbox bracket. Remove transmitter.
(6)Remove packings from fuel tubes and discard packings.
(7)Remove preformed packings from fuel tubes and discard.
(8)Fill transmitter with Engine Oil (Material No.C02-021) or equivalent, in sufficientquantity to coat all parts normally subjected to fuel.
(9)Drain oil.

(10)Install protective covers on open ports of transmitter and fuel tubes.

C. Installation (Ref. Fig. 401)

Pre SB GE 73-224 and Pre SB GE 73-231

WARNING : YOU MUST INSTALL NEW FUEL TUBES. REFER TO GE ALERT SERVICE BULLETIN FOR THE NEW FUEL TUBE PART NUMBERS. IF THE FUEL TUBES ARE NOT REPLACED, IT IS POSSIBLE TO HAVE HIGH PRESSURE FUEL LEAKS. ENGINE FIRE OR DAMAGE CAN OCCUR.

End Pre SB GE 73-224 and End Pre SB GE 73-231

(1)Remove protective covers from transmitter and fuel tubes.
(2)Lubricate new packings with Engine Oil (Material No.C02-023) and install packings onto fuel tubes.
(3)Install transmitter under accessory gearbox bracket with electrical connector aft. Secure transmitter to bracket with bolts and washers.
(4)Attach tubes to transmitter and IDG oil cooler and secure with bolts and washers.
(a)TORQUE bolts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
(5)Attach the fuel inlet tube to the tube flange of the MEC.
(a)Install the bolts that attach the fuel inlet tube and the gasket.
(b)TORQUE bolts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
(6)Connect electrical connector to transmitter. Tighten connector fingertight plus one-eighth turn.

End Pre SB GE 73-085 R2

Post SB GE 73-085 R2 and 73-242 *** (SPRAY SHIELDS ON THE FUEL FLOW TRANSMITTER)

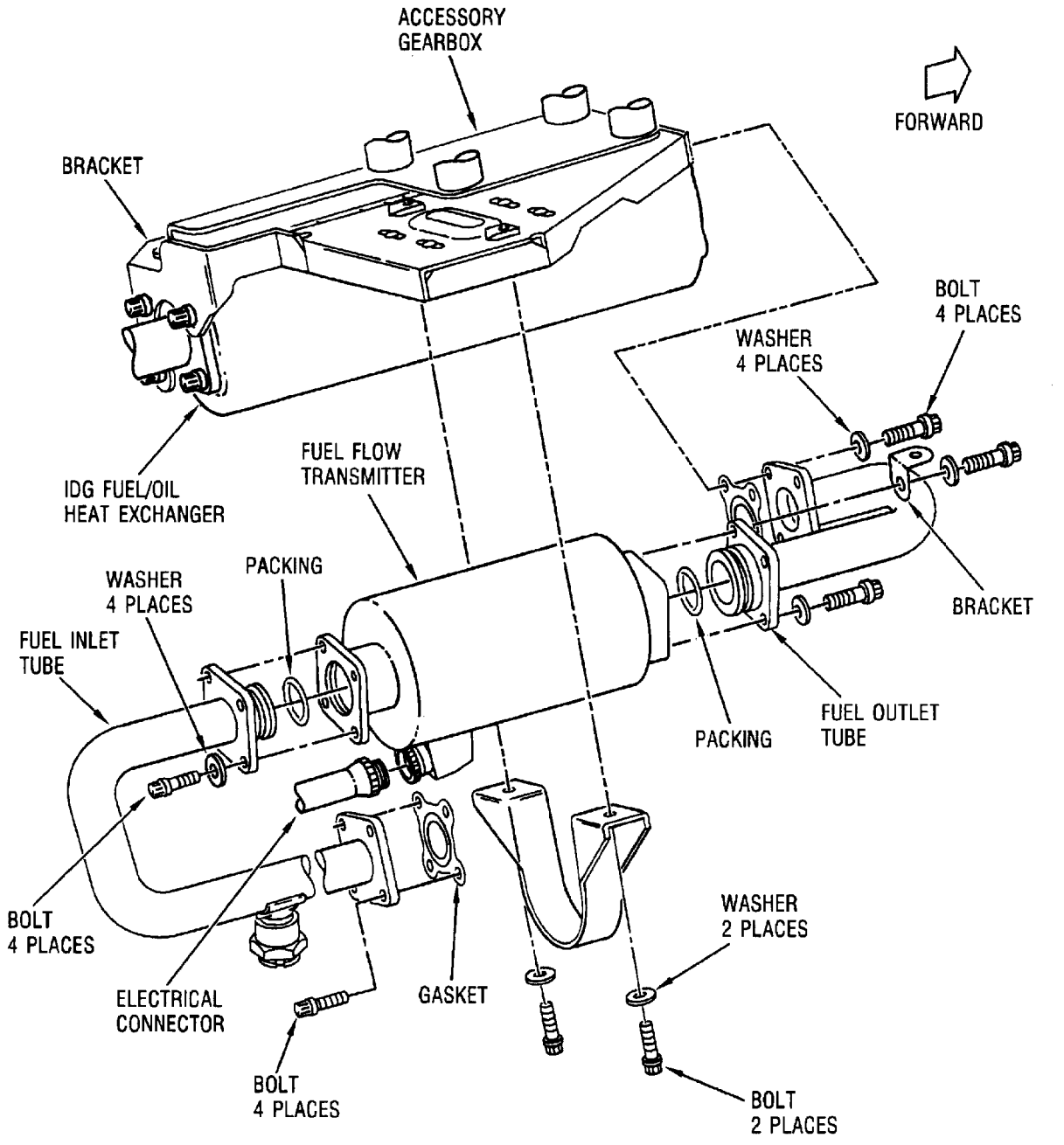
B. Removal (Ref. Fig. 402, 403)

CAUTION : PRESERVE THE FUEL FLOW TRANSMITTER IF IT WILL BE SHIPPED FOR REPAIR OR IF IT WILL BE INSTALLED AFTER TWENTY-FOUR HOURS. THIS WILL PREVENT INTERNAL CORROSION.

(1)Disconnect the electrical connector from the transmitter and install the protective cover on the connector.
(2)Put a container under the fuel flow transmitter.
(3)Remove the four bolts and four washers that attach the spray shield and the fuel inlet tube to the transmitter.
Let the residual fuel in the tube drain into the container.
(4)Remove the four bolts and the four washers that attach the spray shield and the fuel outlet tube to the transmitter.
Let the residual fuel in the tube drain into the container.
(5)Remove the four bolts that attach the fuel inlet tube to the MEC.
Remove the gasket and the fuel inlet tube.
(6)Remove the two bolts and the two washers from the clamp that attaches the transmitter to the AGB bracket. Remove the transmitter.
(7)Remove and discard the packings from the fuel inlet and outlet tubes.
(8)Fill the transmitter with Engine Oil (Material No.C02-021) to sufficiently coat all the parts.
(9)Drain the Engine Oil (Material No.C02-021) from the transmitter.
(10)Install the protective covers on the open ports of the transmitter and the fuel tubes.

C. Installation (Ref. Fig. 402, 403)

Pre SB GE 73-224 and Pre SB GE 73-231



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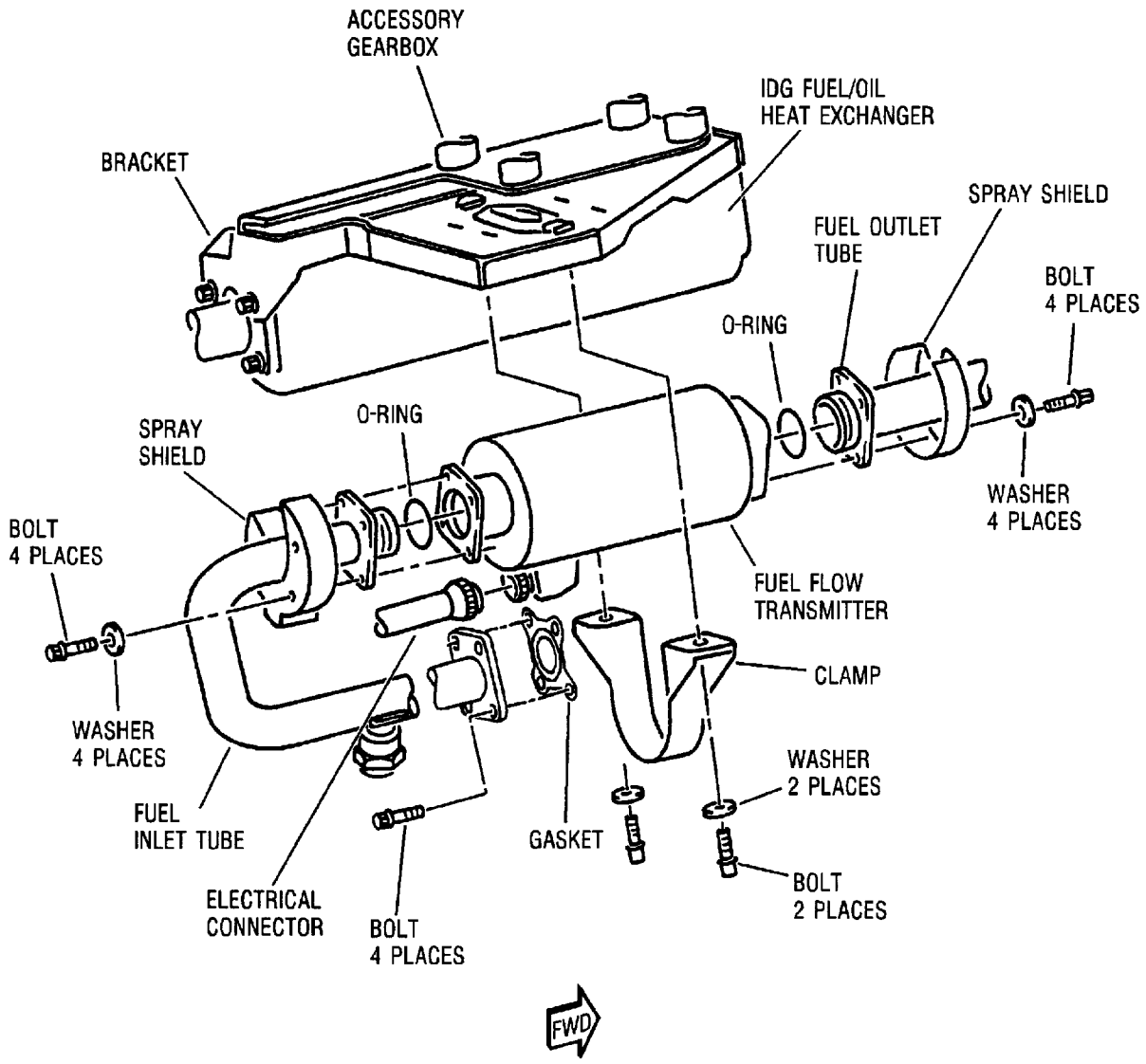
Fuel Flow Transmitter (Pre SB GE 73-085 R2)
Figure 401



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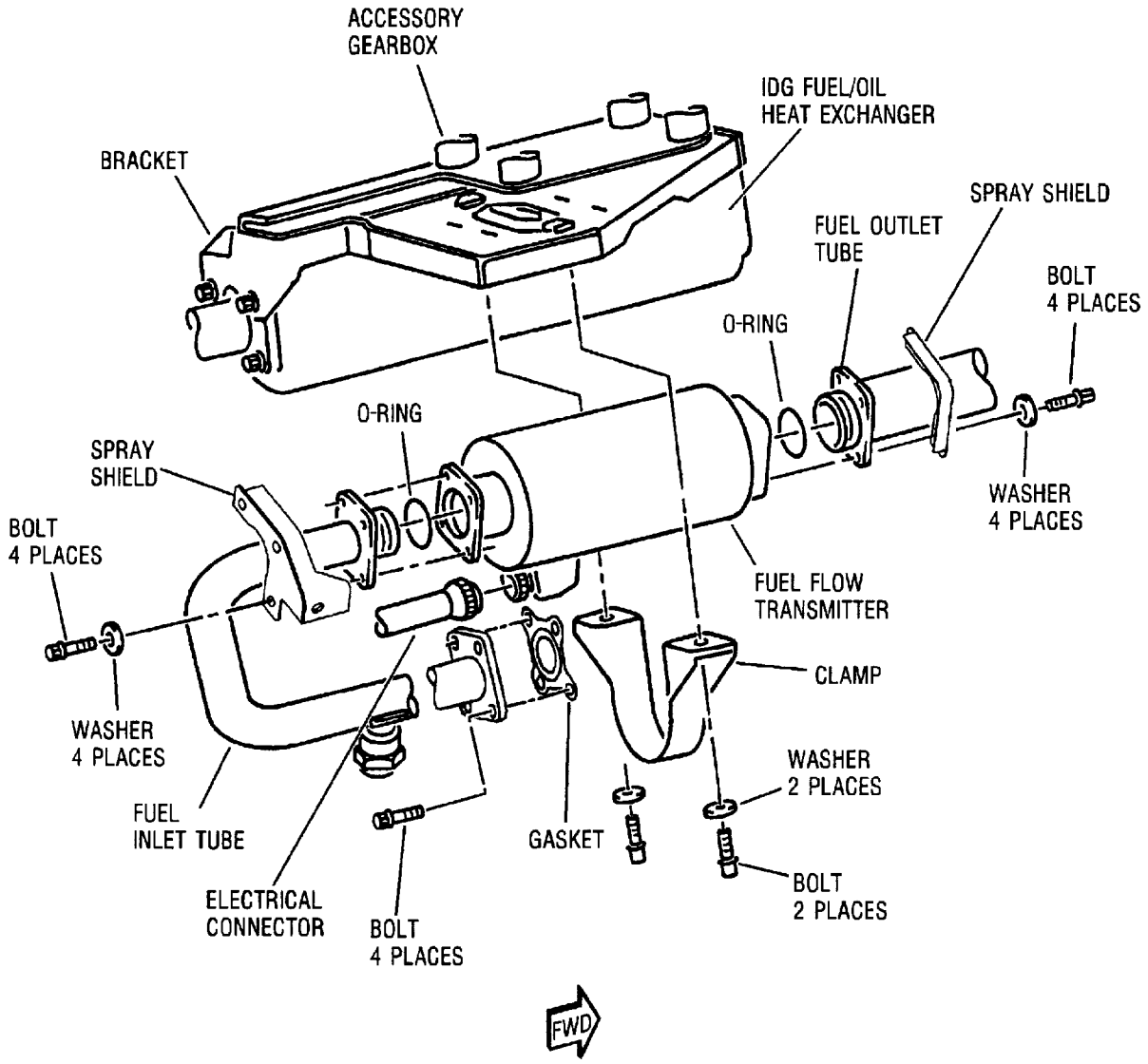
Fuel Flow Transmitter (Post SB GE 73-085 R2)
Figure 402



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Fuel Flow Transmitter (Post SB GE 73-242)
Figure 403

WARNING : YOU MUST INSTALL NEW FUEL TUBES. REFER TO GE ALERT SERVICE BULLETIN FOR THE NEW FUEL TUBE PART NUMBERS. IF THE FUEL TUBES ARE NOT REPLACED, IT IS POSSIBLE TO HAVE HIGH PRESSURE FUEL LEAKS. ENGINE FIRE OR DAMAGE CAN OCCUR.

End Pre SB GE 73-224 and End Pre SB GE 73-231

CAUTION : WHEN YOU INSTALL OR REPLACE THE FUEL FLOWMETER TUBES OR REPLACE THE FLOWMETER TUBE PACKINGS, MAKE SURE THE PACKINGS ARE NOT DAMAGED AND THE TUBES ARE CORRECTLY ATTACHED. HIGH PRESSURE FUEL LEAKS CAN START IF THESE PRECAUTIONS ARE NOT FOLLOWED.

(1)Remove the protective covers from the open ports of the transmitter and fuel tubes.
  (a)If necessary, clean fuel tube flange surfaces to remove any debris.
(2)Inspect the new packings for damage. If there are nicks or tears, discard the packing.
  WARNING : ENGINE OIL IS TOXIC AND FLAMMABLE. USE PERSONAL PROTECTION EQUIPMENT. USE IN A WELL-VENTILATED AREA.
  (a)Lubricate the new packings with Engine Oil (Material No.C02-023) and install them in the fuel tubes.
(3)Install the transmitter as follows :
  (a)Put the fuel flow transmitter, with the electrical connector facing aft, under the AGB bracket.
  (b)Install the transmitter with a clamp, two bolts and two washers.
  (c)Install the four bolts and four washers that attach the spray shield and fuel outlet tube to the transmitter. Tighten the bolts with your fingers.
  (d)Install the four bolts and four washers that attach the spray shield and the fuel inlet tube to the transmitter. Tighten the bolts with your fingers.

CAUTION : WHEN YOU INSTALL THE FUEL FLOWMETER TUBES OR REPLACE THE FLOWMETER TUBE PACKINGS, MAKE SURE THE PACKINGS ARE NOT DAMAGED AND THE TUBES ARE CORRECTLY ATTACHED. HIGH PRESSURE FUEL LEAKS CAN START IF THESE PRECAUTIONS ARE NOT FOLLOWED.

  (e)TORQUE the fuel tube bolts as follows:
    1 Center the four bolt swivel flanges around the tube end ferrule before you torque the bolts.
    2 Use a diagonal or crisscross pattern and TORQUE the bolts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
    3 Use a diagonal or crisscross pattern and TORQUE the bolts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN) for a second time.
(4)Attach the fuel inlet tube to the tube flange of the MEC.
  (a)Install the bolts that attach the fuel inlet tube and the gasket.
  (b)TORQUE the bolts to between 55 and 70 lbf.in. (0.62 and 0.79 m.daN).
(5)Connect the electrical connector to the transmitter. Use your hand to tighten the connector plus one-eighth turn.

End Post SB GE 73-085 R2 and 73-242

D. Test
(1)Remove safety clips and tags and close circuit breakers.
(2)Perform test as indicated in "Type of Testing after Engine Component Replacement" (Ref. 71-00-00, P. Block 501).
(3)On panel 4VU, check that FF indication increases normally.

(4)Check inlet and outlet tubes of the transmitter for leakage.

E. Close-Up

(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(2)Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301). Remove safety clips and tags and close circuit breakers.

FUEL FLOW/FUEL USED INDICATOR - REMOVAL/INSTALLATION

NOTE : Removal/Installation procedures for FF/FU indicators on L and R engines are identical.

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Blanking Caps/Plugs
Referenced Procedure - 73-31-00, P. Block 501	Fuel Flow Indicating

2. Procedure

A. Job Set-Up
(1)Open, safety and tag the following circuit breakers :

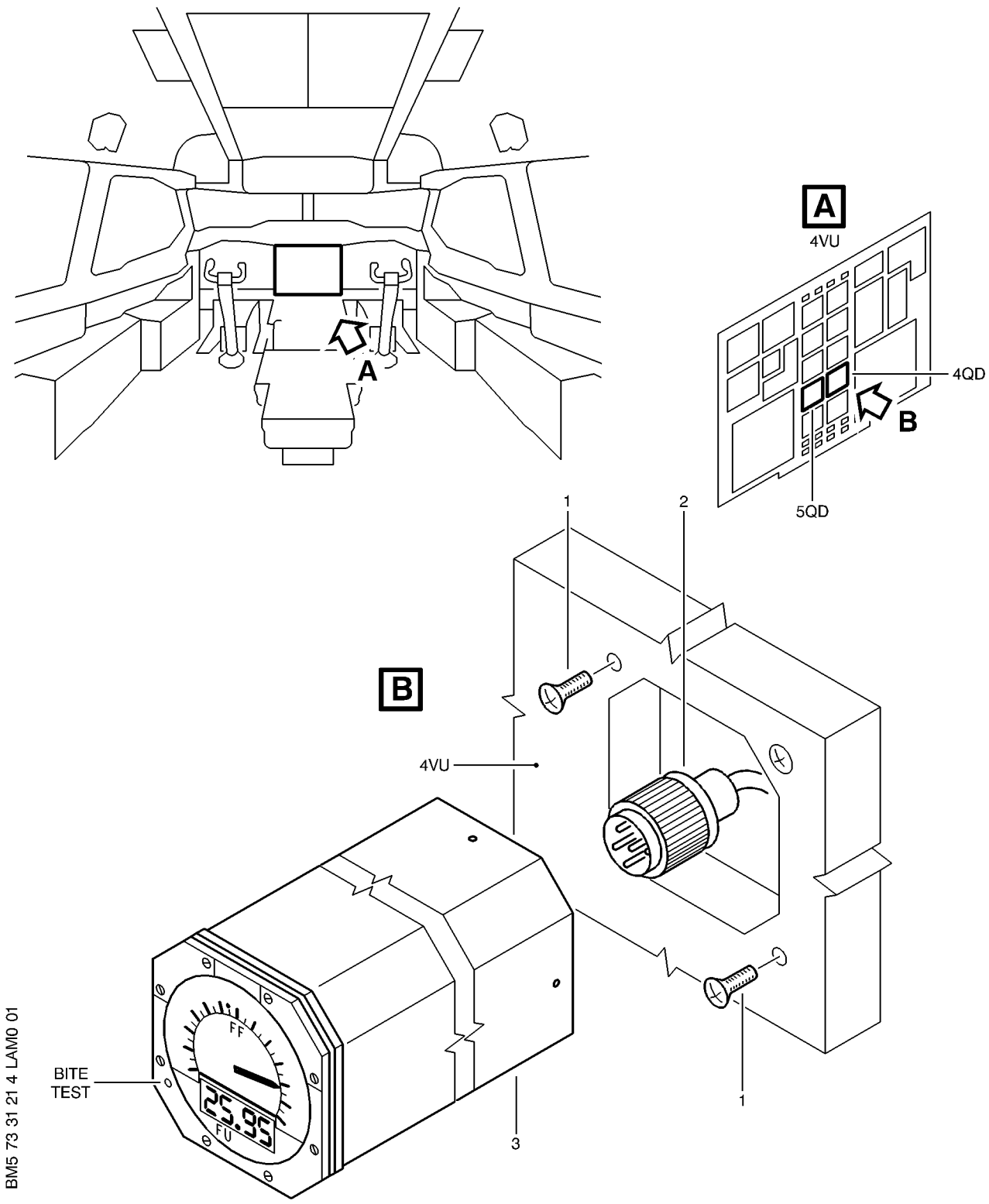
PANEL	SERVICE	IDENT.	LOCATION
133VU	ENGINES/ENG1 FF/FU	1QD	334/S68
133VU	ENGINES/ENG2 FF/FU	2QD	334/S75

B. Removal
(Ref. Fig. 401)
(1)On face of panel 4VU, remove two screws (1) attaching FF/FU indicator.
(2)Remove FF/FU indicator (3) from panel 4VU.
(3)Disconnect FF/FU indicator and blank off plug and receptacle (2).

C. Installation
(1)Check housing of FF/FU indicator on panel 4VU.
(2)Remove blanking caps from plug and receptacle (2) and connect plug.
(3)Install FF/FU indicator (3) in panel 4VU.
(4)Attach FF/FU indicator (3) to panel 4VU with two screws (1).
(5)Remove safety clips and tags and close circuit breakers 1QD and 2QD.

D. Test
Perform indicator test (Ref. 73-31-00, P. Block 501).

E. Close-up
(1)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(2)Restore aircraft systems to normal operating condition.



FF/FU Indicator
Figure 401

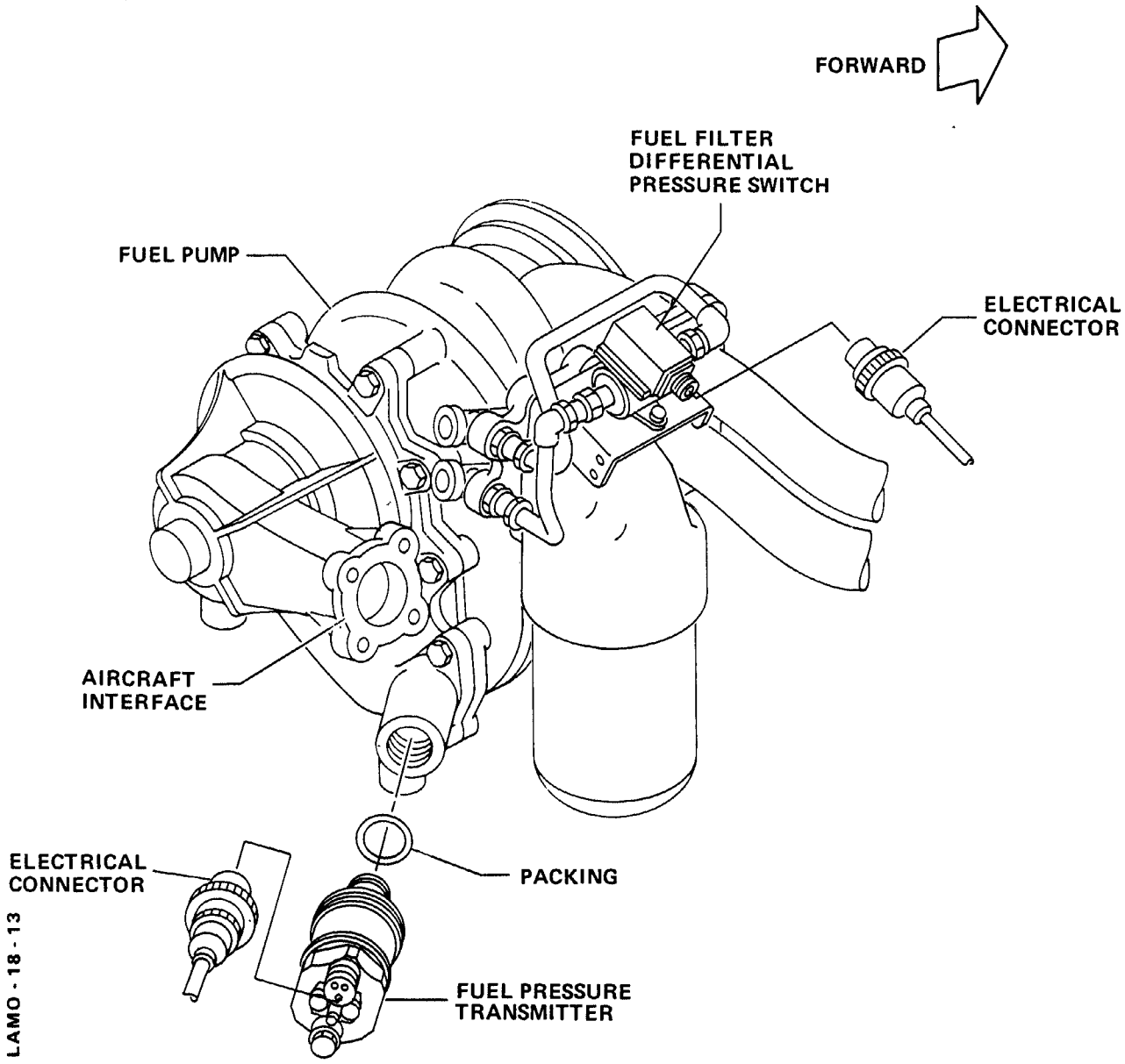
R

FUEL PRESSURE/DESCRIPTION AND OPERATION

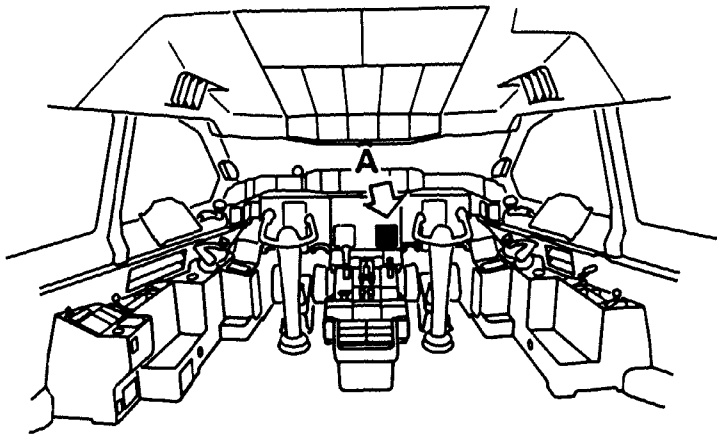
1. Fuel Pressure Transmitter (Ref. Fig. 001)
The fuel pressure transmitter is mounted to the fuel pump. Fuel pressure is sensed at the centrifugal pump outlet and acts on the transmitter's diaphragm. The diaphgram is connected to a movable coil, causing the reluctance of two stationary coils to vary. The transmitter is supplied with 26V - 400Hz from the aircraft (SDAC) and generates an electrical output signal proportional to the fuel pressure ; this signal is transmitted back to the aircraft for display and monitoring. The pressure measured is the difference between the fuel pressure and the compartment. This pressure varies from 0 to 200 psi.

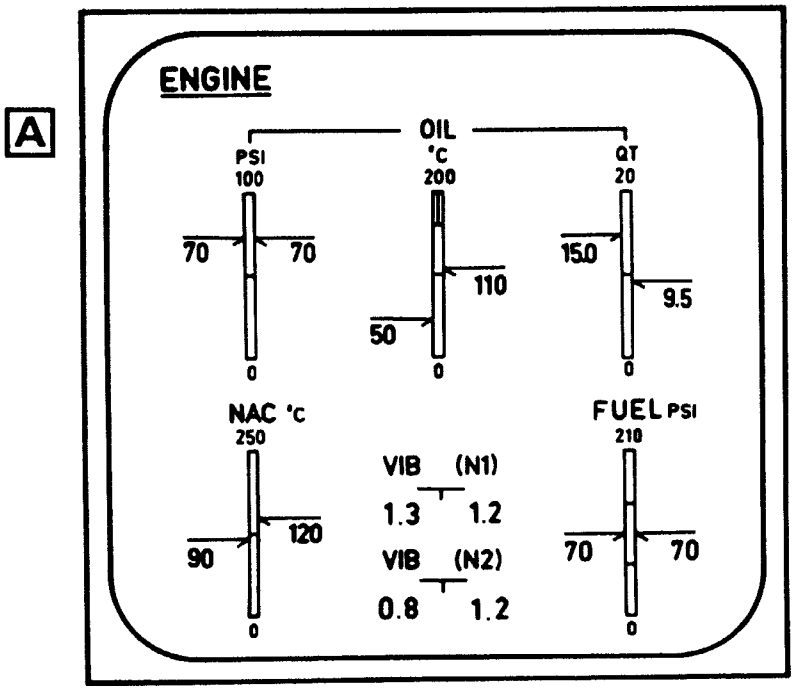
2. Fuel Pressure Indication (Ref. Fig. 003)
(Ref. Fig. 002)
The electrical signal generated by the transmitter is proportional to the fuel pressure and is sent to the SDAC which transform this signal into the digital form and transmits it via the bus line (ARINC 429) to the symbol generator unit (ECAM SGU) and to the R ECAM display unit.
Each time the engine page is displayed (automatically or manually) the fuel pressure is displayed for both engines on a vertical scale graduated from 0 to 200 psi (tolerance ± 1%).
Fuel pressure digital valves flashes green when fuel pressure becomes ≤ 50 psi.

AFT RIGHT SIDE
ACCESSORY GEARBOX



Fuel Pressure Transmitter
Figure 001





ENGINE PAGE

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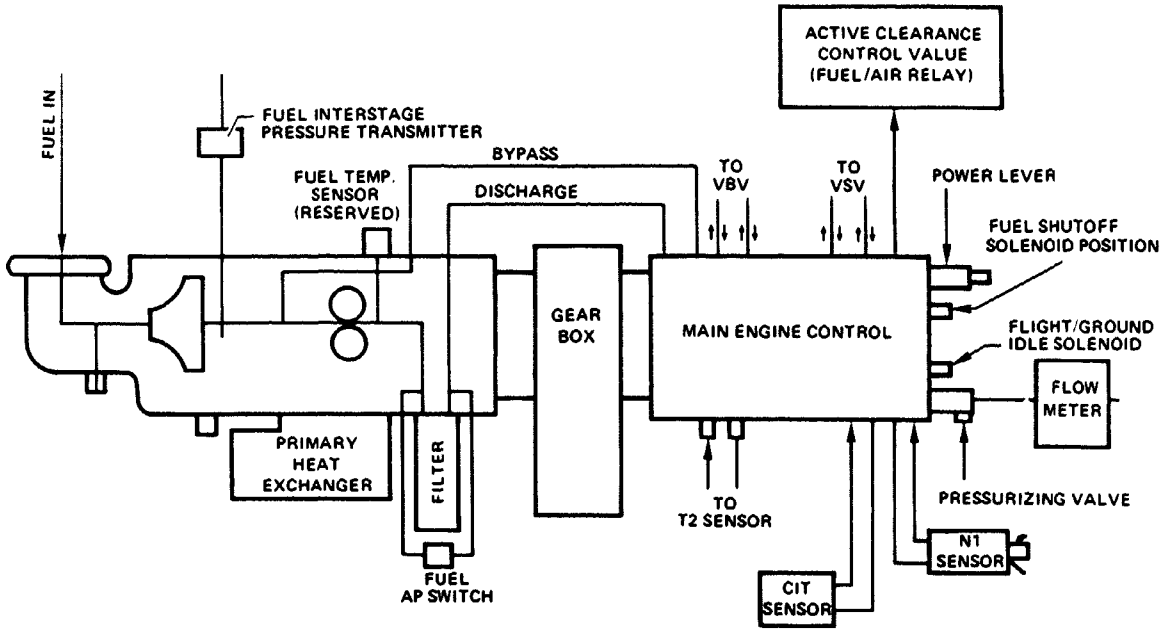
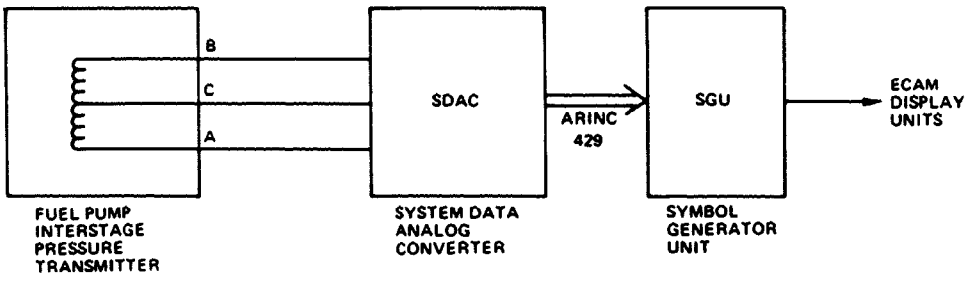
Fuel Pressure Indicating
Figure 002





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DM5

Fuel Pressure Electrical Circuit
Figure 003

FUEL PRESSURE TRANSMITTER - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Torque Wrench 55-300 lbf.in. (0.62 - 3.39 m.daN).
C.	Container 1 US GALLON (4 l)
D.	Packing
E. Material No.C02-023	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 28-24-00, P. Block 1	LP Fuel Fire Shut-Off Control
- 71-00-00, P. Block 501	Power Plant

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
133VU	ENG1 & 2/START/CTL &/WARN	1KG	335/R68
133VU	ENG1 & 2/IGNITION/SYS A	1JH	334/S72
133VU	ENG1 & 2/IGNITION/SYS B	2JH	333/T72
133VU	ENG1/REVERSE/CTL	1KM	332/U69
133VU	ENG2/REVERSE/CTL	2KM	331/V74
133VU	ENG1 & 2/FIRE EXTING/SQUIB A/BTL1	1WE	335/R71
133VU	ENG1 & 2/FIRE EXTING/SQUIB A/BTL2	3WE	335/R72
22VU	FIRE EXTING/ENG1 & 2/SQUIB B/BTL1	5WE	207/C19
22VU	FIRE EXTING/ENG1 & 2/SQUIB B/BTL2	7WE	207/C20

(2)On overhead panel, pull ENG1 (2) FIRE handle (Ref. 28-24-00, P. Block 1).

(3)Open right fan cowl and right thrust reverser doors (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401)

(1)Disconnect electrical connector from transmitter and install a protective cover.

(2)Position a suitable container under transmitter.

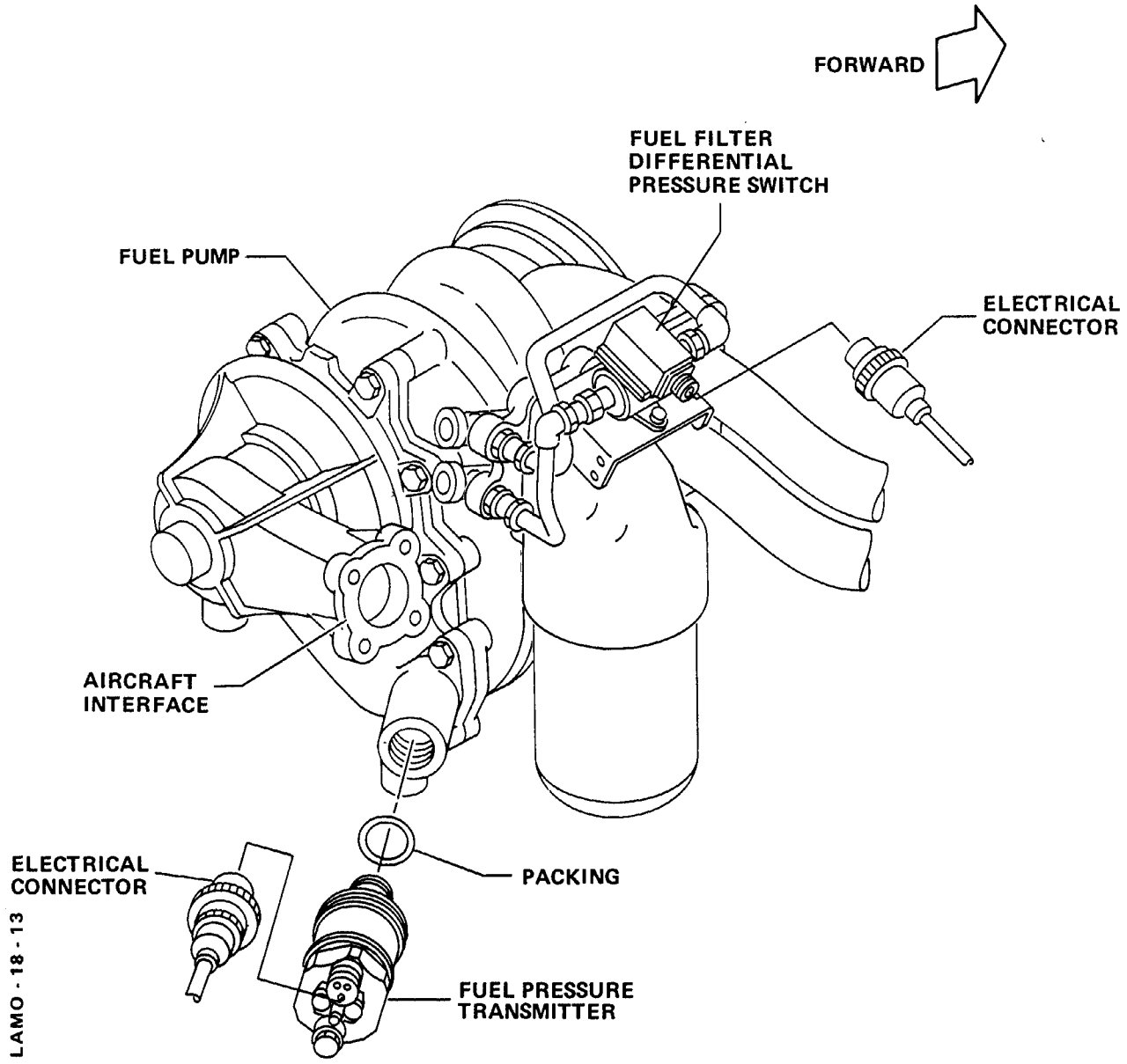
(3)Remove lockwire, and remove transmitter from threads of fuel pump port. Discard packing.

(4)Install a protective cover over the ambient air vent on transmitter and fuel pressure ports and transmitter and pump.

C. Installation (Ref. Fig. 401)

(1)Remove protective covers from transmitter air vent, fuel pressure port

AFT RIGHT SIDE
ACCESSORY GEARBOX



Fuel Pressure Transmitter - Removal/Installation
Figure 401

on transmitter, and pressure port on pump.
(2)Lubricate preformed packing with oil (C02-023) and install over transmitter threads and into packing groove.
(3)Thread transmitter into fuel pump pressure port. TORQUE transmitter to between 230 and 250 lbf.in (2.59 and 2.82 m.daN) and wirelock.
CAUTION : DO NOT CONNECT OIL PRESSURE TRANSMITTER ELECTRICAL CONNECTOR TO FUEL PRESSURE TRANSMITTER.
(4)Connect electrical connector to transmitter. Tighten connector fingertight plus one-eighth turn.

D. Close-Up and Test
(1)On overhead panel, push ENG1 (2) FIRE handle (Ref. 28-24-00, P. Block 1).
(2)Close thrust reverser door (Ref. 71-13-00, P. Block 301).
(3)Remove safety clips and tags and close circuit breakers 1KG, 1JH, 2JH, 1KM, 2KM, 1WE, 3WE, 5WE and 7WE.
(4)Perform test as indicated in "Type of Testing after Engine Component Replacement" (Ref. 71-00-00, P. Block 501).
(5)Press ENG pushbutton switch on ECAM control panel 11VU and check that fuel pressure increases normally on ENGINE page of the R ECAM display unit. After test press CLR pushbutton switch to clear engine page from ECAM system.

FUEL PRESSURE TRANSMITTER - DEACTIVATION/REACTIVATION

1. Reason for the Job

The procedure can be used for temporary maintenance required per MMEL ATA 77-33-1 allowance in the case of an erratic fuel pressure transmitter indication of leaking fuel pressure transmitter.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Torque Wrench 55-300 lbf.in. (0.62-3.39 m.daN)
C.	Container 1 US GALLON (4 l)
D. Material No.C02-021	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
E. Material No.C04-035	Cleaning Compounds and Solvents (Ref. 70-00-00)
F. Material No.C10-071	Miscellaneous (Ref. 70-00-00)
G. Material No.C10-125	Miscellaneous (Ref. 70-00-00)
H. Material No.C10-149	Miscellaneous (Ref. 70-00-00)
J. Material No.C10-206	Miscellaneous (Ref. 70-00-00)
Referenced Procedures	
- 28-24-00, P. Block 1	LP Fuel Fire Shut-Off Control
- 71-00-00, P. Block 501	Power Plant - General
- 71-13-00, P. Block 301	Cowl Doors
- 73-33-11, P. Block 401	Fuel Pressure Transmitter

3. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
133VU	ENG1 & 2/START/CTL &/WARN	1KG	335/R68
133VU	ENG1 & 2/IGNITION/SYS A	1JH	334/S72
133VU	ENG1 & 2/IGNITION/SYS B	2JH	333/T72
133VU	ENG1/REVERSE/CTL	1KM	332/U69
133VU	ENG2/REVERSE/CTL	2KM	331/V74
133VU	ENG1 & 2/FIRE EXTING/SQUIB A/BTL1	1WE	335/R71
133VU	ENG1 & 2/FIRE EXTING/SQUIB A/BTL2	3WE	335/R72
22VU	FIRE EXTING/ENG1 & 2/SQUIB B/BTL1	5WE	207/C19
22VU	FIRE EXTING/ENG1 & 2/SQUIB B/BTL2	7WE	207/C20

(2)On overhead panel, pull ENG1(2) FIRE handle (Ref. 28-24-00, P. Block 1).

(3)Open right fan cowl and right thrust reverser doors (Ref. 71-13-00, P. Block 301).

B. Fuel Pressure Transmitter Deactivation

(Ref. Fig. 901, 902)

(1)Put the container below the fuel pressure transmitter to catch the fuel that remains.

(2)Remove the fuel pressure transmitter (3).

(3)Install the plug (2) into the fuel port where the fuel pressure transmitter (3) was removed.

WARNING : USE PERSONAL PROTECTION EQUIPMENT WHEN YOU USE ENGINE OIL. USE ENGINE OIL IN A WELL-VENTILATED AREA. ENGINE OIL IS TOXIC AND CAN CAUSE HEALTH RISKS TO PERSONS.

(a)Apply engine oil (Material No.C02-021) onto a preformed packing (1).

(b)Put the preformed packing (1) onto the plug (2).

(c)Install the plug (2) into the fuel port on the fuel pump.

(d)TORQUE the plug (2) to between 230 and 250 lbf.in. (2.60 and 2.83 m.daN).

(e)Secure the plug (2) with safety wire (Material No.C10-071).

(4)Store the electrical cable :

(a)Wrap the electrical cable connector with silicone tape (Material No.C10-125).

1 Wrap the connector with minimum of two complete layers of tape.

(b)Route the electrical cable upward to be parallel (doubled-up) with the aft portion of the cable branch.

1 Keep the electrical cable connector at a position away from any interference.

(c)Wrap silicone tape (Material No.C10-125) along the length of the doubled-up cable.

1 Wrap the tape in a continuous manner with 50 percent overlap.

2 Start from the clamp on the cable branch and continue until the entire doubled-up cable and connector are covered.

(d)Apply a minimum of two wraps of lacing and tying tape (Material No.C10-206) to each end of the silicone tape wrap and tie to secure.

(5)Remove the container below the fuel pump.

C. Fuel Pressure Transmitter Reactivation

(Ref. Fig. 901)

(1)Put the container below the fuel pump to catch the fuel that remains.

(2)Remove the plug (2) from the fuel port on the fuel pump.

WARNING : USE PERSONAL PROTECTION EQUIPMENT WHEN YOU USE ENGINE OIL. USE ENGINE OIL IN A WELL-VENTILATED AREA. ENGINE OIL IS TOXIC AND CAN CAUSE HEALTH RISKS TO PERSONS.

(a)Remove the plug (2) from the fuel port on the fuel pump.

(b)Remove the preformed packing (1) from the plug.

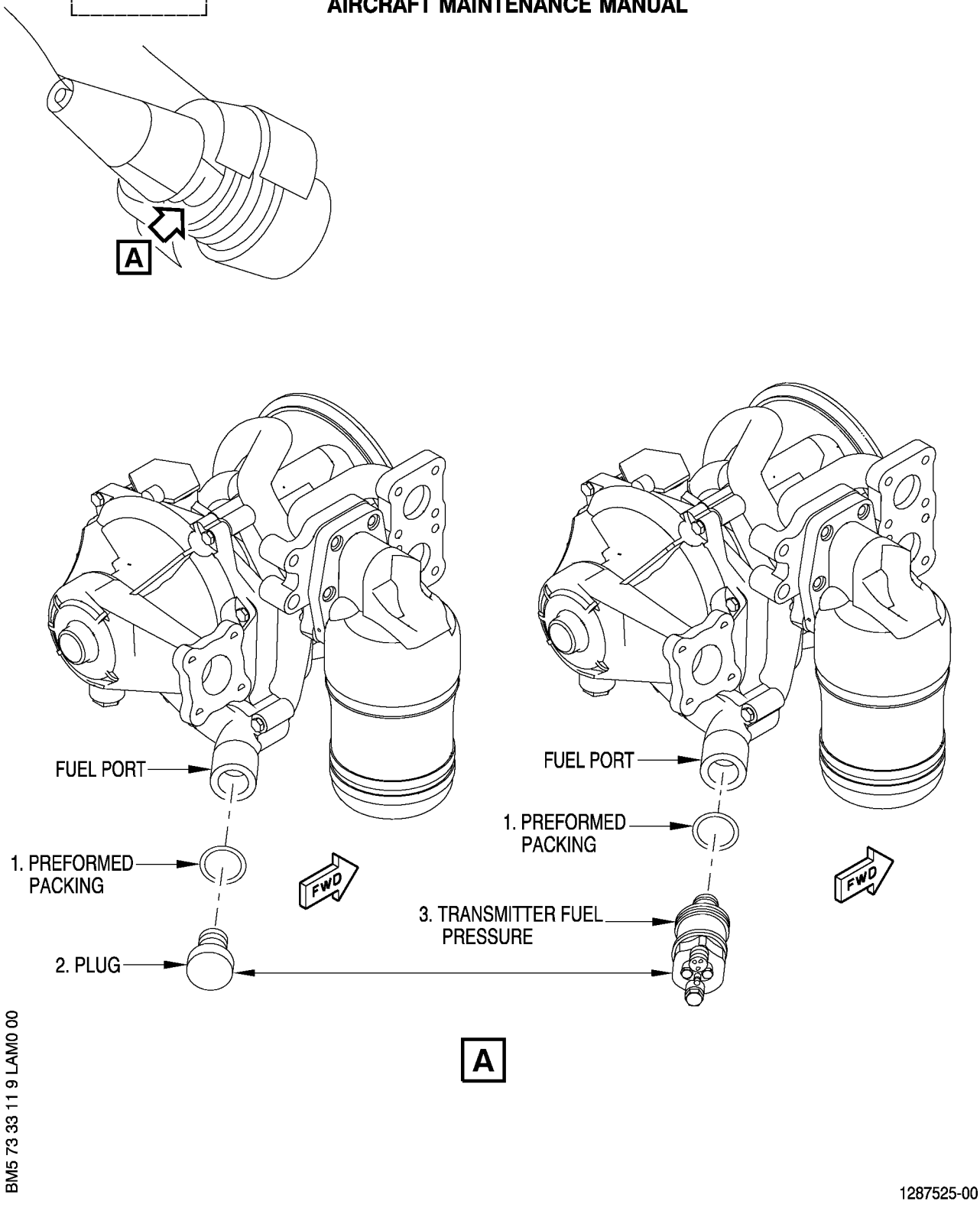
(3)Restore the electrical cable as follows :

CAUTION : USE CARE WHEN YOU CUT AND STRIP THE SILICONE TAPE FROM THE STOWED ELECTRICAL CABLE. IF YOU ARE NOT CAREFUL, DAMAGE TO THE ELECTRICAL CABLE CAN OCCUR.

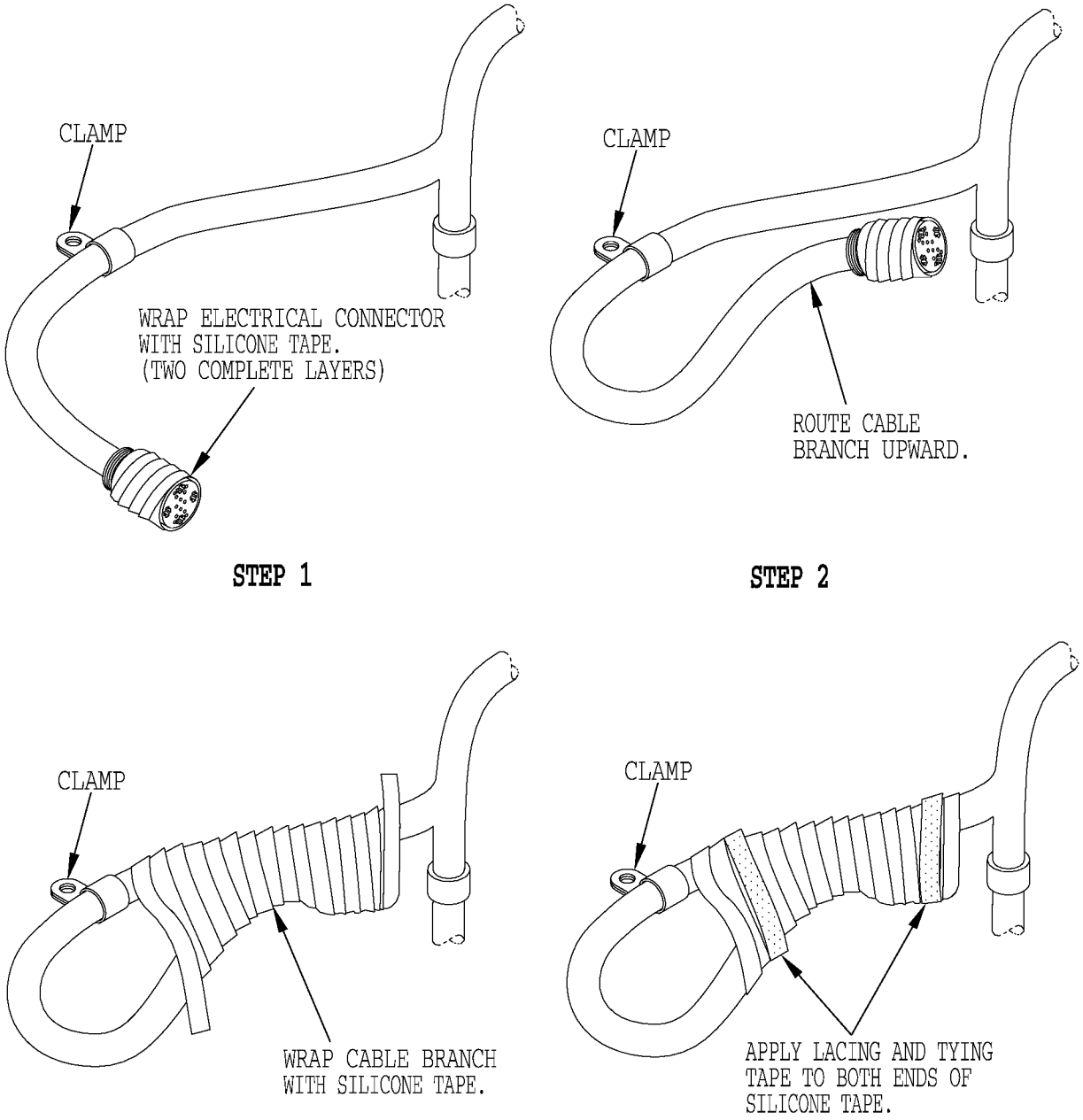
(a)Remove the lacing and tying tape and the silicone tape from the electrical cable branch.

(b)Remove the silicone tape from the electrical cable connector with wire cutters (Material No.C10-149) or equivalent.

WARNING : ISOPROPYL ALCOHOL IS TOXIC AND FLAMMABLE. USE PERSONAL PROTECTION EQUIPMENT IN A WELL-VENTILATED AREA. ISOPROPYL



Fuel Pressure Transmitter - Deactivation /Reactivation
Figure 901



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Fuel Pressure Transmitter - Deactivation /Reactivation
Figure 902

ALCOHOL CAN CAUSE HEALTH RISKS TO PERSONS.

(c)Clean the cable with isopropyl alcohol (Material No.C04-035), to remove any adhesive that remains.

(d)Clean the electrical connector.

(4)Install the fuel pressure transmitter (Ref. 73-33-11, P. Block 401).

D. Close-Up and Test

(1)On overhead panel, push ENG1(2) FIRE handle (Ref. 28-24-00, P. Block 1).

(2)Close thrust reverser door (Ref. 71-13-00, P. Block 301).

(3)Remove safety clips and tags and close circuit breakers 1KG, 1JH, 2JH, 1KM, 2KM, 1WE, 3WE, 5WE and 7WE.

(4)Perform test as indicated in "Type of Testing after Engine Component Replacement " (Ref. 71-00-00, P. Block 501).

(5)Press ENG pushbutton switch on ECAM control panel 11VU and check that fuel pressure is blank on ENGINE page of the R ECAM display unit. After, test press CLR pushbutton switch to clear engine page from ECAM system.

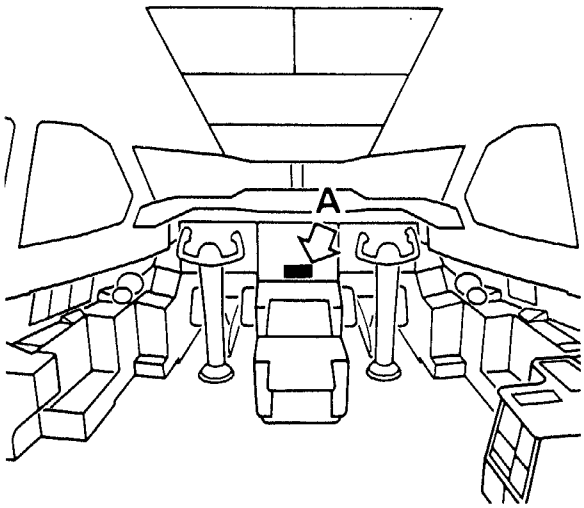
FUEL FILTER CLOGGING - DESCRIPTION AND OPERATION

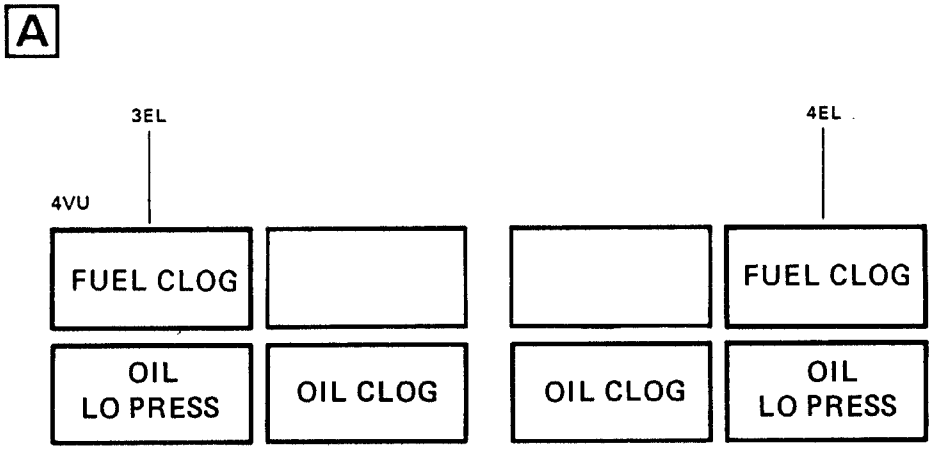
1. General

(Ref. Fig. 001)
(Ref. Fig. 002, 003)

A high loss of pressure in the fuel filter is ascertained by a differential pressure switch connected upstream and downstream of the fuel filter.
When pressure loss in the filter exceeds 21-26 psid, the pressure switch is energized which causes :

- **FUEL CLOG** caution light to come on at the center instrument panel.
- amber **MASTER CAUTION** light to come on flashing accompanied by the single chime.
- the L **ECAM** display unit to supply information for the crew related to the operations to be accomplished, the R **ECAM** display unit to show the **ENGINE** page. When the pressure loss in the filter subsequently decreases below 19.5 psid, the pressure switch is de-energized which causes the caution lights to go off. When pressure loss in the filter reaches 35 ± 5 psid, a filter fuel by-pass valve opens which enables fuel supply without filtering.
  The fuel by-pass valve is fully open at 45 psid.
  FUEL CLOG caution light is supplied with 28VDC by **NORM BUS** by 104PP, 106PP through circuit breaker 1EL (2EL)





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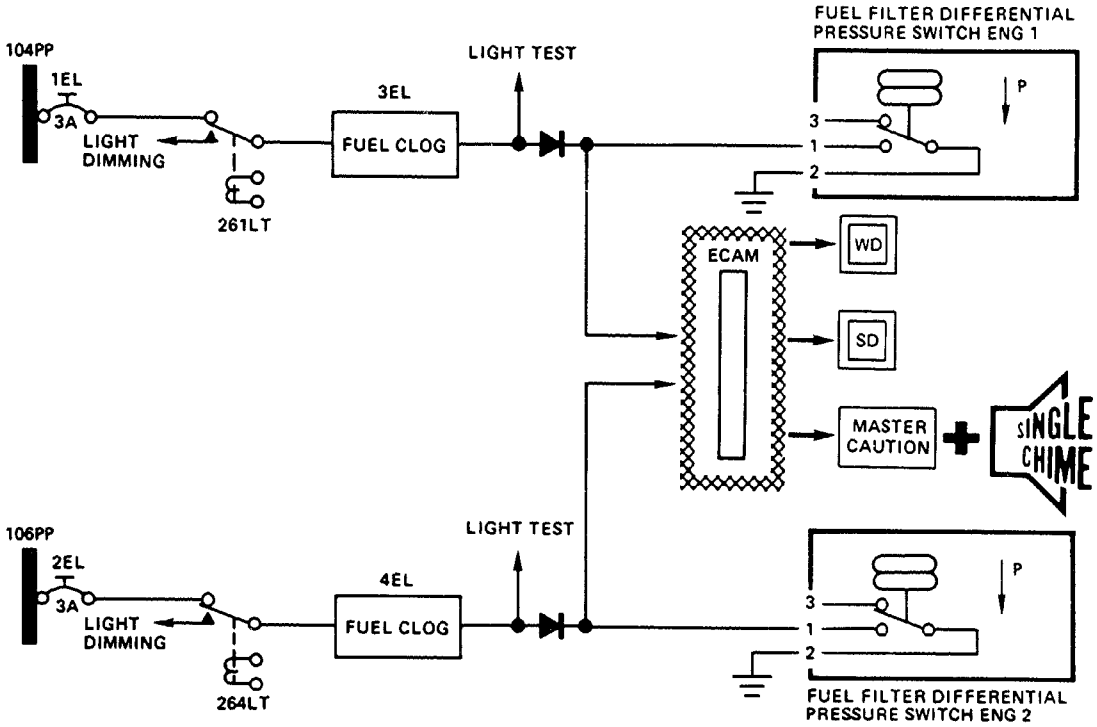
Fuel Filter Clogging - Indication
Figure 001



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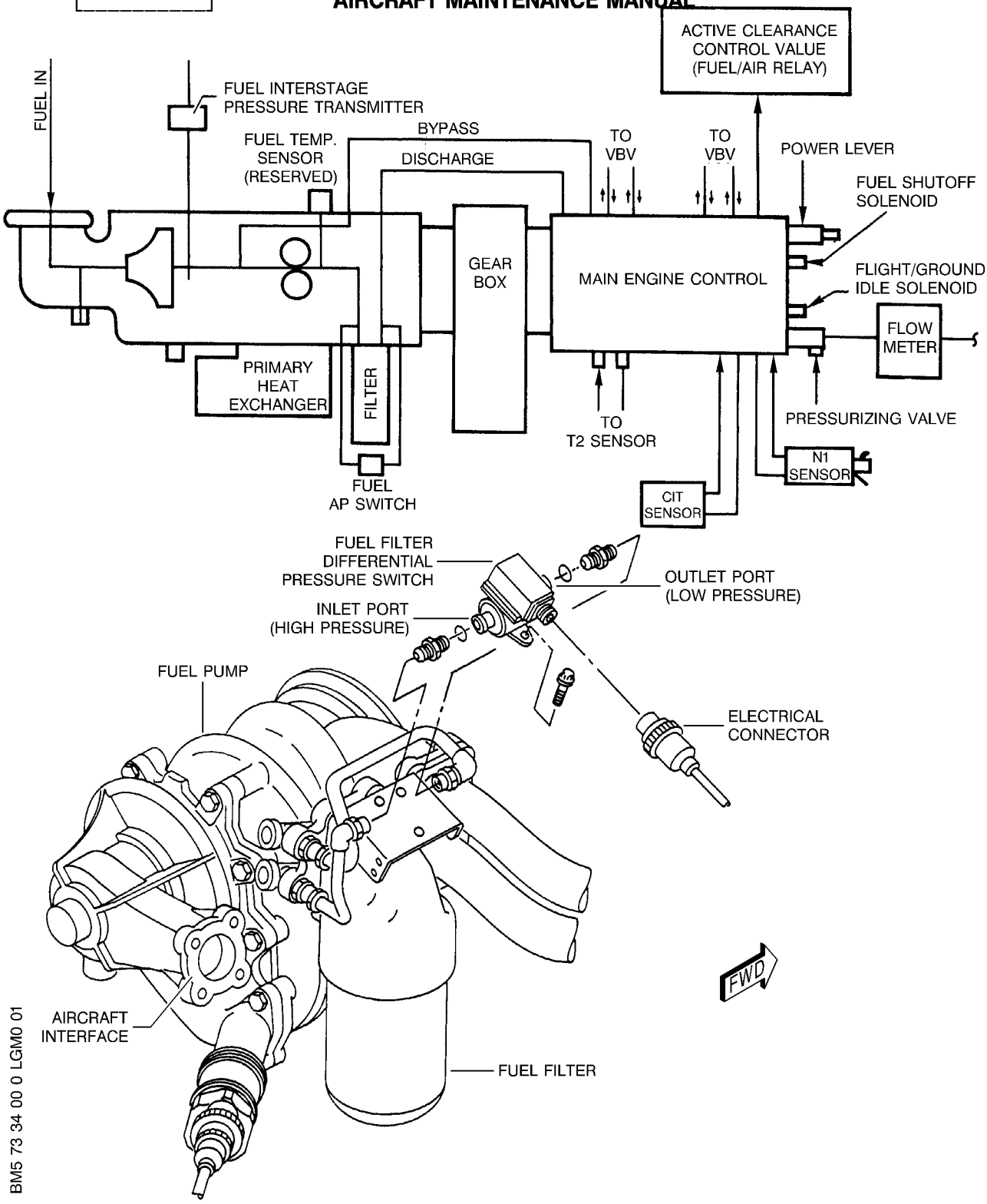
Fuel Filter Clogging - Electrical Circuit
Figure 002



Fuel Filter Differential Pressure Switch
Figure 003

R

FUEL FILTER CLOGGING - ADJUSTMENT/TEST

1. Functional Test

A. Equipment and Materials

ITEM	DESIGNATION
(1)	HP Ground Air Supply
(2)	Container Suitable for Fuel
Referenced Procedures	
- 24-41-00, P. Block 301	AC External Power Control
- 71-13-00, P. Block 301	Cowl Door
- 73-34-11, P. Block 401	Fuel Filter Differential Pressure Switch

B. Procedure

(1)Job Set-Up

(a)Initial conditions

- correct electrical power supply
- circuit breakers closed particularly those associated with ECAM, ENGINES
- forward services ventilation system in operation.

(b)On center pedestal, on ECAM CTL PNL

- using LEFT DISPLAY knob, adjust brightness on left ECAM display unit
- press MASTER CAUTION light until MASTER CAUTION light goes off on CAPT and F/O main instrument panels 3VU and 5VU.

(c)Open, safety and tag the following circuits breakers :

PANEL	SERVICE	IDENT.	LOCATION
133VU	START CTL & WARN	1KG	335/R68
133VU	ENG2/REV/CTL	2KM	331/V74
133VU	ENG1/REV/CTL	1KM	332/U69
133VU	ENG1/FUEL/HP VALVE CTL	3KC	333/T69
133VU	ENG2/FUEL/HP VALVE CTL	4KC	333/T70
133VU	ENG1 & 2/IGNITION SYS A	1JH	334/S72
133VU	ENG1 & 2/IGNITION SYS B	2JH	333/T72
133VU	ENG1/FUEL HP VALVE WARN	1KC	333/T68
133VU	ENG2/FUEL HP VALVE WARN	2KC	335/R73
133VU	ENG1 & 2 FIRE EXTING SQUIB A BTL1	1WE	335/R71
133VU	ENG1 & 2 FIRE EXTING SQUIB A BTL2	3WE	335/R72
22VU	ENG1 & 2/SQUIB B BTL1	5WE	207/C19

(d)On the FIRE control module (overhead panel) of the engine concerned, pull the fire handle and install a warning notice to prohibit actuation in normal position (pushed) while maintenance is in progress.

(e)Open fan cowl doors (Ref. 71-13-00, P. Block 301).

(f)Install container under fuel differential pressure switch and

R disconnect tubing couplers on inlet (high pressure) and (low pressure) outlet ports of switch (Ref. 73-34-11, P. Block 401).

R (g)Connect compressed air source to switch inlet (high pressure) port.

(2)Test

ACTION	RESULT
1. Supply compressed air source at a pressure between 21 and 26 psig. (1.47 and 1.82 bar)	On center instrument panel 4VU : - FUEL CLOG warning light(s) comes on.
2. Press INHIBIT OVRD pushbutton switch on the ECAM maintenance panel 47OVU	- MASTER CAUTION light comes on on CAPT and F/O main instrument panels 3VU and 5VU accompanied by the single chime. On left ECAM display unit - ENG1 (2) FUEL FILTER CLOG - THR1 (2)... BELOW WARN . IF WARN AT IDLE - ENG1 (2) PWR FOR SAFE FLT ONLY
3. Slowly reduce air pressure to 19.5 psig (1.37 bar) and stabilize at this pressure	- FUEL CLOG warning light(s) goes off on center instrument panel (4VU). - MASTER CAUTION light goes off on CAPT and F/O main instrument panels 3VU and 5VU and ENGINE page of the left ECAM display unit disappears.

(3)Close-Up

(a)Disconnect compressed air source.

R (b)Connect tubing couplers on inlet (high pressure) and outlet (low
R pressure) ports of pressure switch (Ref. 73-34-11, P. Block 401).

(c)On the appropriate FIRE control module, push the fire handle and remove the warning notice.

(d)Remove safety clips and tags and close circuit breakers 1KG, 3KC, 4KC, 1KC, 2KC, 1WE, 3WE, 5WE and 7WE.

(e)Wet motor engine (Ref. 71-00-00, P. Block 301).

(f)Check for leakage.

(g)De-energize the aircraft electrical networks (Ref. 24-41-00, P. Block 301).

(h)Close fan cowl doors (Ref. 71-13-00, P. Block 301).

(i)Remove container.

(j)Remove safety clips and tags and close circuit breakers 1JH, 2JH, 2KM and 1KM.

(k)Restore system and aircraft to normal operating condition.

FUEL FILTER CLOGGING - DEACTIVATION/REACTIVATION

Ref. : MMEL Sect. 1-73, ITEM 7 ("FUEL CLOG" lt.)

1. Reason for the Job
   Failure of FUEL CLOG warning light system.

2. Equipment and Materials

ITEM	DESIGNATION
A.	Warning Notice
B.	Circuit Breakers Safety Clips
Referenced Procedures	
- 71-13-00, P. Block 301	Cowl Doors
- 73-12-02, P. Block 401	Fuel Filter Element

3. Procedure

A. Job Set-Up
(1)Open, safety and tag the appropriate circuit breakers and open the fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).

B. Deactivation
(1)Remove fuel filter element (Ref. 73-12-02, P. Block 401).
(2)Check filter and if necessary replace it.
(3)Install fuel filter element (Ref. 73-12-02, P. Block 401).

R C. Close-Up
R (1)Install a warning notice in flight compartment indicating that eng. 1 (2) fuel filter clogging indicating system is inoperative.

FUEL FILTER DIFFERENTIAL PRESSURE SWITCH - REMOVAL/INSTALLATION

1. Equipment and Materials

ITEM	DESIGNATION
A. Material No.C02-023	Antiseize Compounds Lubricants Oils (Ref. 70-00-00)
B.	Protective Covers
C.	Torque Wrench 140-300 lbf. in. (1.58 - 1.69 m.daN)
D.	Container 1 US GALLON (4 l)
E.	Packing
Referenced Procedures	
- 28-24-00, P. Block 1	LP Fuel Fire Shut-Off Control
- 71-00-00, P. Block 501	Power Plant
- 71-13-00, P. Block 301	Cowl Doors

2. Procedure

A. Job Set-Up

(1)Open, safety and tag the following circuit breakers :

PANEL	SERVICE	IDENT.	LOCATION
133VU	ENG 1/FUEL/CLOG	1EL	331/V72
133VU	ENG 2/FUEL/CLOG	2EL	332/U72
133VU	ENG 1 & 2/START/CTL &/WARN	1KG	335/R68
133VU	ENG 1 & 2/IGNITION/SYS A	1JH	334/S72
133VU	ENG 1 & 2/IGNITION/SYS B	2JH	333/T72
133VU	ENG 1/REVERSE/CTL	1KM	332/U69
133VU	ENG 2/REVERSE/CTL	2KM	331/V74
133VU	ENG 1 & 2/FIRE EXTING/SQUIB A/BTL 1	1WE	335/R71
133VU	ENG 2 & 2/FIRE EXTING/SQUIB A/BTL 2	3WE	335/R72
22VU	FIRE EXTING/ENG 1 & 2/SQUIB B/BLT 1	5WE	207/C19
22VU	FIRE EXTING/ENG 1 & 2/SQUIB B/BLT 2	7WE	207/C20

(2)On overhead panel, pull ENG 1 (2) FIRE handle (Ref. 28-24-00, P. Block 1)

(3)Open right fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).

B. Removal (Ref. Fig. 401, 402)

(1)Disconnect the electrical connector from the pressure switch. Install protective covers on the electrical connector and the pressure switch.

(2)Put an applicable container below the fuel tubes.

(3)Disconnect the "B" nut (2) from the fuel pump and move it aft. Let the remaining fuel drain from the tube.

(4)Disconnect the "B" nut (3) from the reducer (10) on the pressure switch then remove tube (7).

(5)Disconnect the "B" nut (4) from the fuel pump and move it aft. Let the remaining fuel drain from the tube.

Pre SB GE 73-020
(6)Disconnect the "B" nut (5) from the reducer (10) on the pressure switch.
(7)Remove the two reducers (10) and the packings from the pressure switch. Discard the packings.
End Pre SB GE 73-020
Post SB GE 73-020
(6)Disconnect the "B" nut (5) from the elbow (8) on the pressure switch.
(7)Loosen the jam nut (9) on the elbow (8) ; then remove the reducer (10), elbow with jam nut, and the packings from the pressure switch. Discard the packings.
End Post SB GE 73-020
(8)Remove the bolts that hold the pressure switch to the bracket (1).
(9)Install protective covers in the pressure switch ports and the fuel tubes.

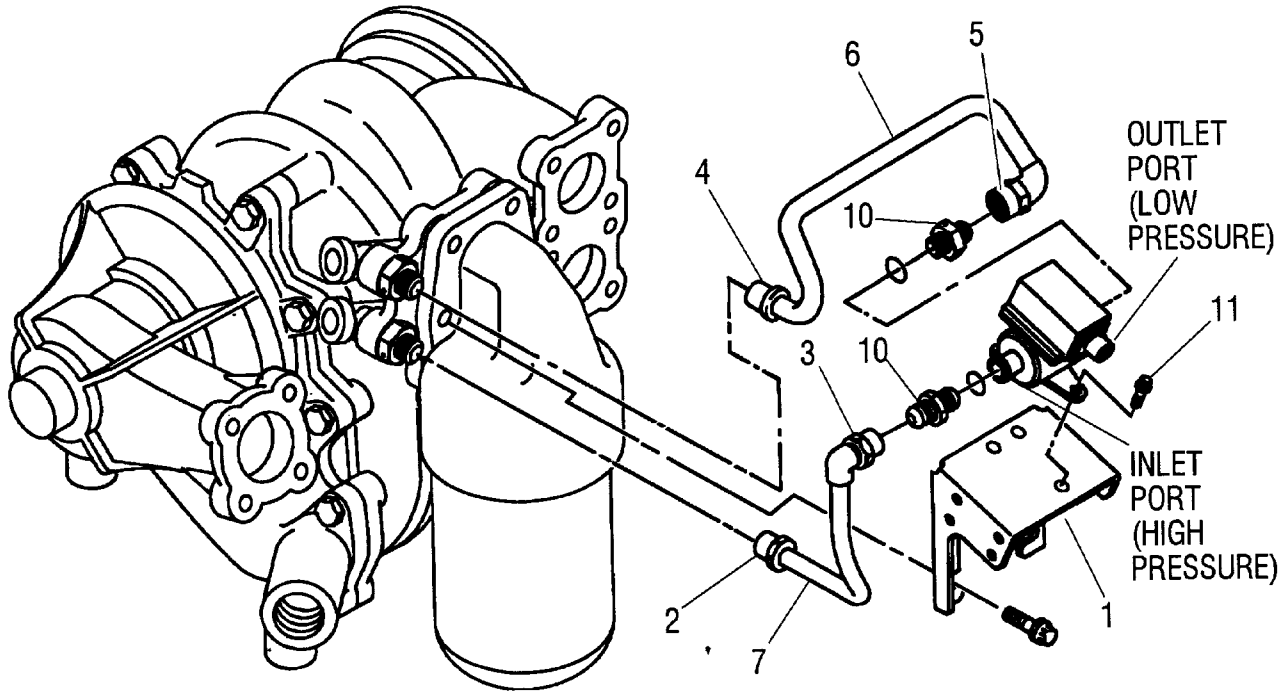
C. Installation (Ref. Fig. 401, 402)
(1)Remove the protective covers from the pressure switch ports and the fuel tubes.
Pre SB GE 73-020
(2)Lubricate two new packings with Engine Oil (Material No.C02-023). Install the new packings on the reducers (10). Install the reducers in the pressure switch. TORQUE the reducers to between 135 and 155 lbf.in. (1.53 and 1.75 m.daN).
End Pre SB GE 73-020
Post SB GE 73-020
(2)Lubricate two new packings with engine oil (Material No.C02-023). Install the reducer (10) and elbow (8) as follows :
(a)Install the two packings on the reducer (10) and the elbow (8) with the jam nut (9).
(b)Loosely connect the elbow (8) on the pressure switch. Put the packing on the elbow (8) with the jam nut (9) as shown in (Ref. Fig. 402) (Sheet 2/2).
Rotate the elbow (8) until the jam nut (9) just contacts the switch port.
(c)Install the reducer (10) on the pressure switch and TORQUE the reducer (10) to between 135 and 155 lbf.in. (1.53 and 1.75 m.daN).
End Post SB GE 73-020
(3)Install the pressure switch on bracket (1) with bolts. Tighten the bolts hand tight less one turn.
Pre SB GE 73-020
(4)Loosely connect tube (6) to the reducer (10) on the pressure switch. Loosely connect other end of tube (6) to the fuel pump. Loosely connect tube (7) to the fuel pump. Loosely connect the other end of the tube (7) to the pressure switch. TORQUE the "B" nut (5) to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).
End Pre SB GE 73-020
Post SB GE 73-020
CAUTION : WHEN YOU INSTALL THE FUEL TUBE, ALIGN THE ELBOW WITH THE FUEL TUBE BY ROTATING THE ELBOW IN THE COUNTER-CLOCKWISE DIRECTION ONLY (FORWARD LOOKING AFT) NO MORE THAN ONE TURN. IF YOU DO

NOT, DAMAGE TO PREFORMED PACKING AND FUEL LEAKAGE CAN OCCUR.

(4)Loosely connect tube (6) to the elbow (8) on the pressure switch.
Loosely connect other end of tube (6) to the fuel pump.
Loosely connect tube (7) to the fuel pump. Loosely connect the other end of the tube (7) to the pressure switch.
TORQUE the jam nut (9) on the elbow (8) to between 135 and 155 lbf.in. (1.53 and 1.75 m.daN).
NOTE : When correctly installed, 0 to 1 threads will be exposed on the elbow (8) beyond the jam nut (9) as shown in (Ref. Fig. 402) (Sheet 2/2)

End Post SB GE 73-020
Pre SB GE 73-238
(5)TORQUE the "B" nut (2,3 and 4) to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).
End Pre SB GE 73-238
Post SB GE 73-238
(5)TORQUE the "B" nut (2,3 and 4) to between 135 and 155 lbf.in. (1.53 and 1.75 m.daN).
End Post SB GE 73-238
Pre SB GE 73-020
(6)TORQUE the "B" nut (5) to between 270 and 300 lbf.in. (3.05 and 3.39 m.daN).
End Pre SB GE 73-020
Post SB GE 73-020
(6)TORQUE the "B" nut (5) to between 135 and 155 lbf.in. (1.53 and 1.75 m.daN).
End Post SB GE 73-020
(7)TORQUE the bolt (11) that attaches the switch to the bracket to between 33 and 37 lbf.in. (0.37 and 0.42 m.daN).
(8)Install one interfacial seal in the pressure switch. Connect the electrical connector to the pressure switch.
Tighten the electrical connector with your hand plus one-eighth of a turn.

D. Close-Up and Test
(1)On overhead panel, push ENG 1 (2) FIRE handle (Ref. 28-24-00, P. Block 1).
(2)Remove safety clips and tags and close circuit breakers 1EL, 2EL, 1KG, 1JH, 2JH, 1KM, 2KM, 1WE, 3WE, 5WE and 7WE.
(3)Close thrust reverser doors
(4)Perform test as indicated in "Type of Testing after Engine Component Replacement" (Ref. 71-00-00, P. Block 501).
(5)Check that ENG 1 (2) FUEL CLOG legend is off.
(6)Open thrust reverser doors.
(7)Check fuel filter differential pressure switch for fuel leakage.
(8)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.
(9)Close fan cowl and thrust reverser doors (Ref. 71-13-00, P. Block 301).

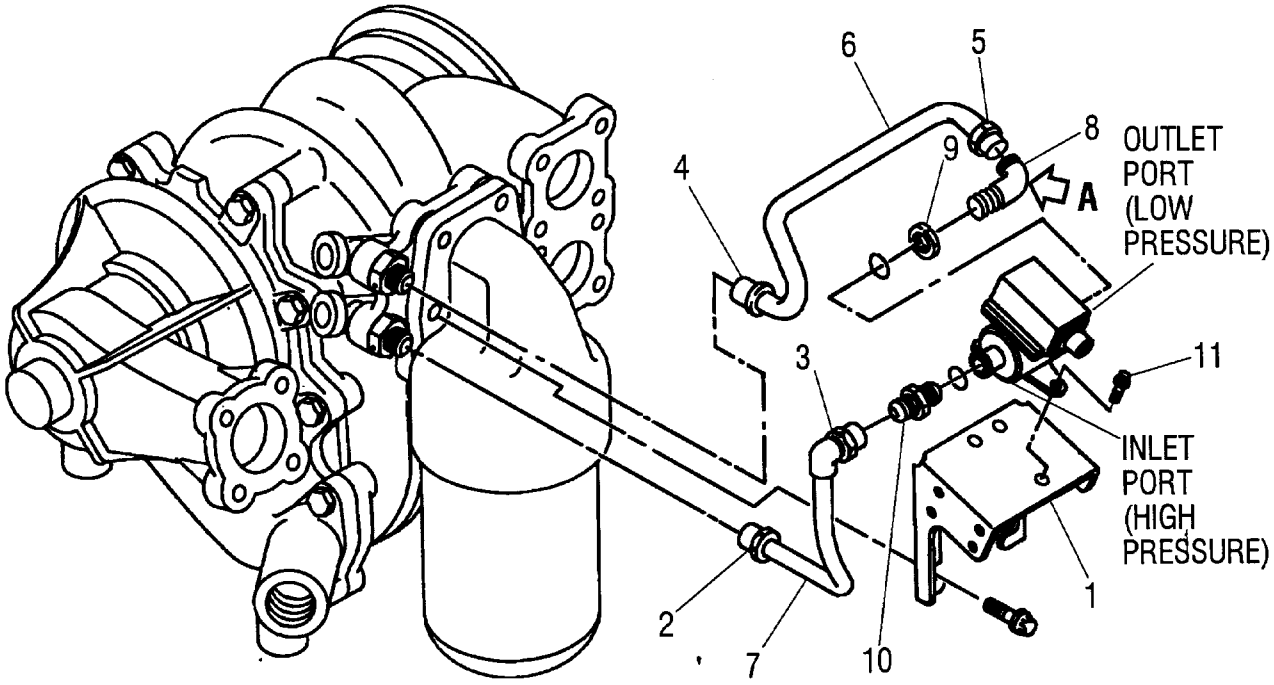


1240752-00

BM5 73 34 11 4 LCMO 02

Fuel Filter Differential Pressure Switch
(Pre SB GE 73-020)
Figure 401

R



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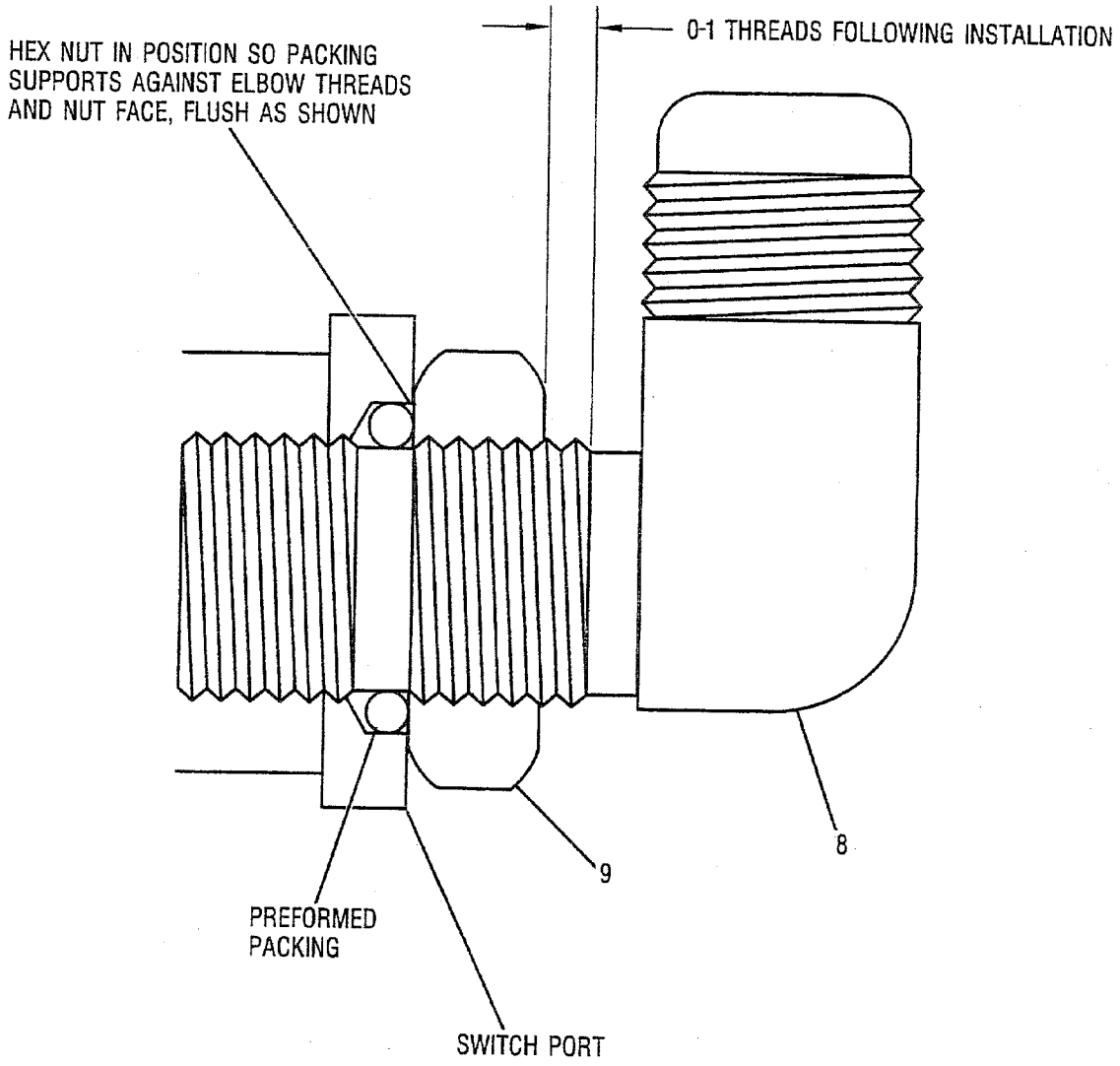
BM5 73 34 11 4 LAMA 01

Fuel Filter Differential Pressure Switch
(Post SB GE 73-020) (Sheet 1/2)
Figure 402

R

A


HEX NUT IN POSITION SO PACKING SUPPORTS AGAINST ELBOW THREADS AND NUT FACE, FLUSH AS SHOWN
0-1 THREADS FOLLOWING INSTALLATION
8
9
PREFORMED PACKING
SWITCH PORT

BM5 73 34 11 4 LAMJ 00

1195738-00-A

Fuel Filter Differential Pressure Switch
(Post SB GE 73-020) (Sheet 2/2)
Figure 402